4 Emerging Technologies

Let us learn

Different Emerging Technologies.

- Basics of Internet Of Things (IOT).
- Basics of cloud computing.
- Introduction to Artificial Intelligence (AI).
- Introduction to 5G.

4.1 IoT (Internet of Things)

The Internet of things (IoT) is the network of physical devices, vehicles, home appliances, and other items embedded with electronics, software, sensors, actuators, and connectivity. It enables these things to connect, collect and exchange data, creating opportunities for more direct integration of the physical world into computer-based systems, resulting in efficiency improvements, economic benefits. This reduces human efforts.

IOT involves extending Internet connectivity beyond standard devices, such as desktops, laptops, smartphones and tablets, to any range of traditionally dumb or non-internet-enabled physical devices and everyday objects. Embedded with technology, these devices can communicate and interact over the Internet, and they can be remotely monitored and controlled.

Advantages :

- **Efficient resource utilization :** If we know the functionality and the way that how each device works, we definitely increase the efficient resource utilization as well as monitor natural resources.
- **Minimize human effort :** As the devices of IoT interact and communicate with each other and do lot of task for us, then they minimize the human effort.
- **Time saving :** As it reduces the human effort then it definitely saves out time. Time is the primary factors in automation which can save through IOT platform.
- **Enhance Data Collection :** IoT devices can collect data from environment like weather, sound, pollution etc. This data then can be used to take decisions.
- **Improve, security :** IoT based security systems can make home or office environment secure.

Disadvantages :

- **Privacy :** Even without the active participation on the user, the IoT system provides substantial personal data in maximum detail.
- **Complexity :** The designing, developing, maintaining and enabling

the large technology to IoT system is quite complicated.

Applications of IoT :

- Smart lighting - Illumination of light is controlled on the basis of day light.
- Smart thermostats - Allows users to schedule, monitor and remotely control home temperatures.
- Smart locks and garage-door openers - Password based or facial recognition based doors and locks.
- Smart security cameras – Security cameras that can identify known and unknown person and raise alarm, in case of security threat.
- Smart traffic signals – Signal that can adjust their timing to accommodate commutes and holiday traffic and keep cars moving.

4.2 Cloud Computing

Cloud computing is a model for enabling, convenient on-demand network access to a shared pool of computing resources like network, servers, storage, applications and services released with service provider interaction.

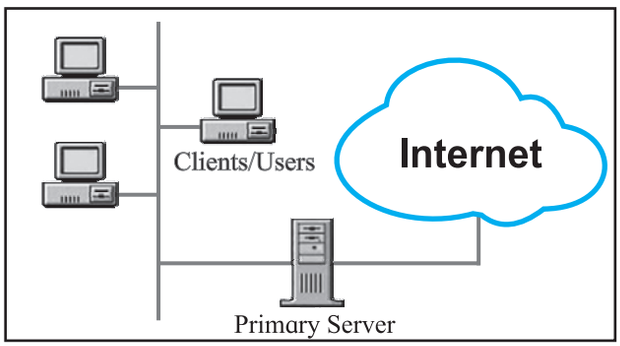

Fig. 4.1 : Cloud Computing

Models of Cloud computing :

There are three primary service models of cloud computing that are Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS).

Infrastructure as a service (IaaS)

IaaS gives users access to storage, networking, servers and other computing resources via the cloud. While the user is still responsible for managing their applications, data, middleware, etc. IaaS provides automated and scalable environments that provide a high degree of control and flexibility for the user.

Key features :

- Instead of purchasing hardware outright, users pay for IaaS on demand.
- Infrastructure is scalable depending on processing and storage needs.
- Enterprises saves the costs of buying and maintaining their own hardware.

Examples : Amazon web services (AWS) ec2, Microsoft Azure VM, Google Compute Engine (GCE)

Platform as a service (PaaS)

A service provider offers access to a cloud-based environment in which users can develop, manage and deliver applications. In addition to storage and other computing resources, users are able to use a suite of prebuilt tools to develop, customize and test their own applications.

Key features :

- PaaS provides a platform with tools to test, develop and host applications in the same environment.
- Enables organizations to focus on development without having a worry about underlying infrastructure.
- Providers manage security, operating systems, server software and backups.
- Facilitates collaborative work even if teams work remotely.

Do it yourself

Find example of Paas

Software as a service (SaaS)

A service provider delivers software and applications through the internet. Users do not install applications on their local devices. Instead, the applications reside on a remote cloud network accessed through the web or an API.

Key features :

- SaaS vendors provide users with software and applications via a subscription model.
- Users do not have to manage, install or upgrade software; SaaS providers manage this.
- Data is secure in the cloud; equipment failure does not result in loss of data.
- Use of resources can be scaled depending on service needs.
- Applications are accessible from almost any internet-connected device, from virtually anywhere in the world.

Examples : Google's G suite, GitHub, SAP, Slack, Dropbox.

Types of Cloud Computing :

There are three basic types of deployment of cloud computing that are Public, Private and Hybrid.

Public Cloud :

In public cloud, all the services and supporting infrastructure are managed off-site over the internet and shared across multiple users. Public cloud are more efficient and inexpensive than private and hybrid cloud solutions.

Examples : Amazon AWS, Microsoft Azure, Google Cloud Platform.

Private cloud :

As the name suggests private cloud provides I.T services through the internet or a private network to selected users rather than to general public. All the data is protected behind the firewall. Private cloud solutions are preferred for enhanced security and privacy by the users.

Hybrid Cloud :

Hybrid cloud environments combines both Public and Private cloud elements. The clouds in a Hybrid environment communicate over an encrypted connection and allow for the portability of data and applications. Hybrid cloud allows greater flexibility as compared to that of public and private cloud solutions.

Benefits of Cloud Computing :

Cost saving : Cloud computing solutions are inexpensive than the actual overall Infrastructure set up for the I.T services.

Reliable : Cloud computing solutions are more reliable than In-house I.T infrastructure.

Mobility : Cloud computing solutions are more portable because user can access data anytime, anywhere as required.

4.3 AI (Artificial Intelligence)

Artificial intelligence (AI) is an area of computer science that emphasizes on creation of intelligent machines that work and react like humans.

AI is different from robotics, but related to some extent, in which machines sense their environment, perform calculations and do physical tasks either by themselves or under the direction of people.

AI has some sub fields like-

- Machine learning automates analytical model building, to find hidden insights in data without being programmed to look for something in particular or draw a certain conclusion.
- Neural networks imitate the brain's array of interconnected neurons, and relay information between various units to find connections and derive meaning from data.
- Deep learning utilizes really big neural networks and a lot of computing power to find complex patterns in data, for applications such as image and speech recognition.
- Cognitive computing is about creating a "natural, human-like interaction", including using the ability to interpret speech and respond to it.
- Computer vision employs pattern recognition and deep learning to understand the content of pictures and videos, and to enable machines to use real-time images to make sense of what's around them.
- Natural language processing involves analyzing and understanding human language and responding to it.

Advantages of Artificial Intelligence :

Reduction in human error : Computers if programmed properly with artificial Intelligence gives 100% accuracy as compared to task performed by human as there is always a chance for human mistakes.

Digital Assistance : Some of the highly advanced organizations use digital assistants to interact with users which saves the need for human resources. Example- chatbot

Faster Decisions : Using AI alongside other technologies, we can make machines take decisions faster than a human and carry out actions quicker.

Daily Applications : Daily applications such as **Apple's Siri, Window's Cortana, Google's OK Google** are frequently used

in our daily routine whether it is for searching a location, taking a selfie, making a phone call, replying to a mail and many more.

Disadvantages of AI :

High Costs of Creation- As the machines used in AI based environments are very complex and high in price, it increases the cost for overall set up.

Unemployment- As AI is replacing the majority of the repetitive tasks and other works with robots. This will reduced human interference but cause a major problems in the employment standards.

4.4 5G

5G is the fifth generation of cellular network technology.

5G is the next generation of wireless communications. It is expected to provide Internet connections that are multiple times faster than 4G LTE (Long Term Evolution). 5G technology may use a variety of spectrum bands, including millimeter wave (mmWave) radio spectrum, which can carry very large amounts of data at a short distance. The drawback of the higher frequencies is that they are more easily obstructed by the walls of buildings, trees and other foliage, and even changes in the weather.

The new 5G networks will be able to transmit very large amounts of data—but only a few blocks at a time. 5G networks are digital cellular networks, in which the service area covered by providers is divided into small geographical areas called cells.

5G can support upto a million devices per square kilometer, compared to 4G.

Features of 5G are shown in fig. 4.2

Applications :

1) Online 5G Games.
2) Automated Vehicles.
3) Virtual Classrooms.

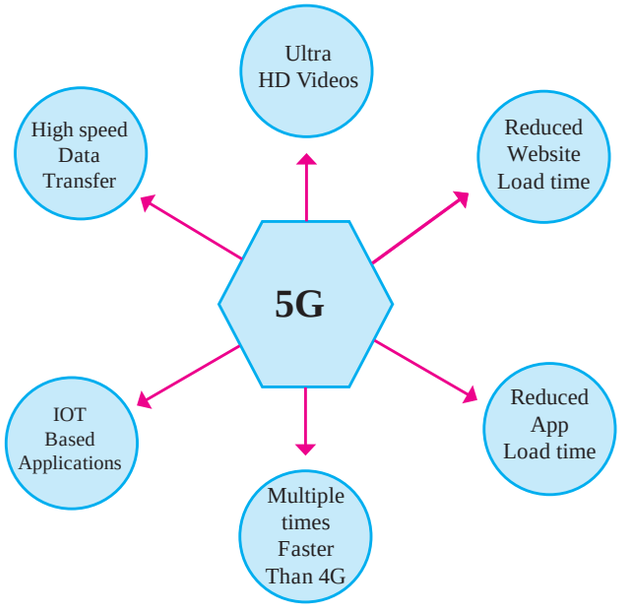

Fig. 4.2 : Features of 5G

Do it yourself

Find out various technologies used in smart cities

Summary

- IOT stands for Internet of Things.
- With the help of applications based on IOT various social and critical problems can be solved. for e.g. Traffic problem, Air pollution, water pollution.
- AI Stands for Artificial Intelligence.
- With the help of AI we can approach higher accuracy and privacy.
- 5G is the fastest method of data transfer.

Exercise

Q.1 Fill in the blanks.

1. IOT is Referred as .....
2. Smart Home is the application of ..... Technology.
3. Amazon is the ..... service provider.

Q.2. Match the pair.

'A'	'B'
1) Smart city	a) Software as a Service
2) Amazon web server	b) Platform as a Service
3) PaaS	c) Cloud computing
4) SaaS	d) IOT

Q.3. State whether the given statement is True or False.

1. PaaS provides a platform with tools to test, develop and host applications in the same Environment.

   .....

2. Cloud computing means to store and access data and programs over the internet.

   .....

Q.4 Explain the followings.

1. Give some applications of IOT.
2. Explain in detail about cloud computing.
3. Explain models of cloud computing.
4. Give brief idea about AI.
5. Explain the concept of 5G.