Lecture-1 ABESIT College of Engineering (290) UNIT-1

Emerging Technology for engineering (KMC-101)

INTERNET OF THINGS -

The IOT describes the network of physical objects - "things" - that are embedded with sensors, software and other technologies for the purpose of connecting and exchanging data with other devices and system over the Internet.

IoT systems have applications across industries through their unique flexibility and cibility to be suitable in any environment. They enhance data collection, automation, operations and much more through smart devices and powerful enabling technology.

IoT - key features - The most important feature of IoT include artificial intelligence, sensors, active engagement and small device use.

↳ Artificial Intelligence (AI) - IoT essentially makes virtualey anything smart, meaning it ehhances every aspect of life with the power of data collection, artificial

intelligence algorithms and networks.

↳ Connectivity – New enabling technologies for networking, and specifically IoT networking, means network are no longer exclusively tied to major providers. Networks can exist on a much smaller and cheaper scale with still being practical. IoT realis these small networks b/w its system devices.

↳ Sensors – IoT loses its distinction without sensors. They act as defining instruments which transform IoT devices from a standard passive network of real-world integration. into a active system capable

↳ Active Engagement – Much of today's interaction with connected technology happens through passive engagement. IoT introduces a new paradigm for active content, product or service engagement.

↳ Small devices - Devices, as predicted, have become smaller, cheaper and more powerful over time. IoT exploits purpose-built small devices to deliver its precision, scalability and versatility.

IoT Advantages -

① Improved Customer Engagement - Current analytics suffer from blind-spots and significant flaws in accuracy; and as noted, engagement remains passive. IoT completely transforms this to achieve richer and more effective engagement with audi-ences.

② Technology Optimization - The same technolog-ies and data which improve the customer experience also improve device use and aid is more important improvement to Technology.

(3) Reduced Waste — IoT makes areas of improvement clear, current analytics gives us superficial insight, but IoT provides real-world insight leading to more effective management of resources.

(4) Enhanced Data Collection — Modern data collection suffers from its limitations and its design for passive use. IoT breaks it out of those spaces, and places it exactly where humans really want to go to analyze our world. It allows an accurate picture of anything.

IoT Disadvantages —

(1) Security — IoT creates an ecosystem of constantly connected devices communicating over networks. The system offers little control despite any security measures. This leaves users exposed to various kinds of attackers.

(2) Privacy — The sophistication of IoT provides substantial personal data in extreme detail without the user's active participation.

(3) Complexity — Some find IoT systems complicated in terms of design, deployment and maintenance given their use of multiple technologies and a large set of new enabling technologies.

(4) Flexibility — Many are concerned about the flexibility of an IoT system to integrate easily with another.

(5) Compliance — IoT, like any other technology in the realm of business, must comply with regulations. Its complexity makes the issue of compliance seem incredibly challenging when many consider standard software compliance a battle.

Lecture-2. ABESIT College of Engineering (290). UNIT-2

Emerging Technology for Engineering (KHS-101)

LO – Student will be able to understand uses of Sensors

Sensors – The term IoT stands for Internet of Things and it is the most significant as well as promising technology now-a-days. There are billions of devices connected with sensors like smartphones etc.

Sensors play an essential role in the IoT. These sensors are mainly used for detecting or monitoring the quality of air, health status, home security etc.

The main function of these sensors is to gather information from the surroundings. All the sensors are not same because different IoT applications need different kinds of sensors.

Types of IoT Sensors – These are some IoT sensors –

→ Temprature Sensor – The temprature sensor is used to detect the heat energy which is produced from an object otherwise nearby area. These sensors are applicable for IoT, which includes from manufacturing to farming. The main role of these sensors in manufacturing is for temprature monitoring of machines. Similarly, in the agriculture field, these sensors are used to monitor the temprature of plants, soil and water.

→ IR (Infrared Sensors) – IR sensors are mainly used to measure the heat which is produced by objects. These sensors are used in the various applications of IoT like health care for monitoring the flow of blood, B.P. etc. These sensors are used in smartphones for controlling, wearable devices for detecting the amount of light etc.

→ Accelerometer sensor – Accelerometer sensors are used in different applications to identify the direction of an object.

→ Smoke Sensor – Smoke sensors have been using in various application like homes, industries etc. These sensors are very convenient as well as easy to use by the arrival of the IoT. Also, by adding a wireless conn^{n} to smoke detectors, the additional features can be enabled to increase security and ease.

→ Motion Sensor – It is used for security reasons, these are used in automatic parking system, automatic door controls, automated toilet flushers etc.

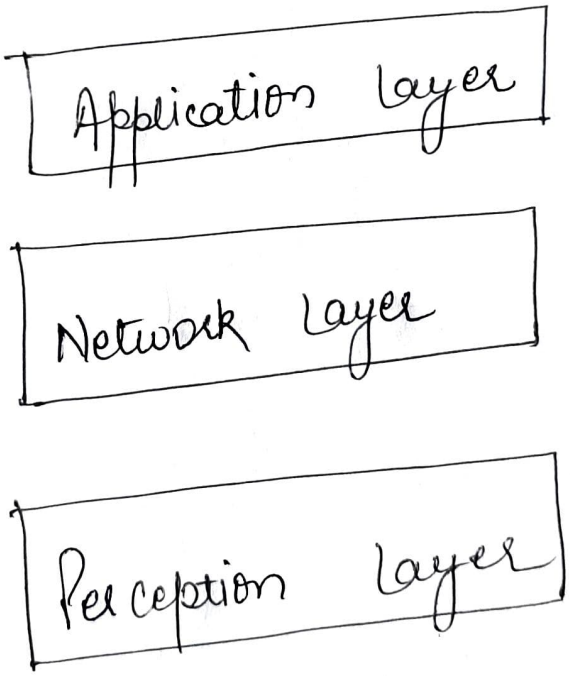
→ Pressure Sensor – The pressure sensors are used in IoT for monitoring and systems which are determined by force signals. TMPS (Tyre Pressure Monitoring System) can also be used for giving an alert to the driver while tyre is extremely less pressured.

Emerging Technology for Eng (KMC-101)

LO- Students will be able to understand layered architecture of IOT.

IoT Layers — There is no single consensus on architecture for IoT, which is agreed universally. Different architectures have been proposed by different researchers.

→ Three and five layer Architecture —



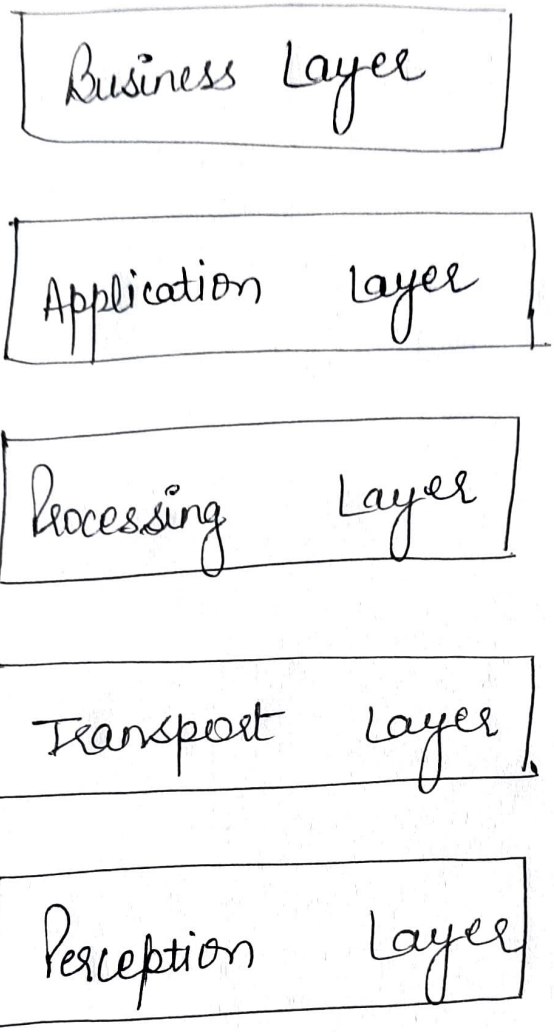
three-layer Architecture —

It was introduced in the early stages of research in this area. It has 3 layers –

① Perception Layer – It is the physical layer, which has sensors for sensing and gathering information about the environment. It senses some physical parameters or identifies other smart objects in the environment.

② Network Layer – It is responsible for connecting to other smart things, network devices and servers. Its features are also used for transmitting and processing sensor data.

③ Application Layer – This layer is responsible for delivering applications specific services to the user. It defines various applications in which the IoT can be deployed, for example, smart homes, smart cities and smart health.



5- layer Architecture -

3- layer architecture is not sufficient for research on IoT because research often focuses on finer aspects of the IoT. That's why five layer architecture was Proposed.

functioning of remaining three layers are as follows –

→ Transport Layer – Transport layer transfers the sensor data from the perception layer to the processing layer and vice-versa through networks such as wireless, LAN, Bluetooth etc.

→ Processing Layer – It is also known as middleware layer. It stores, analyzes and process huge amount of data that comes from transport layer. It employs many technologies such as database, cloud computing and big data processing modules.

→ Business Layer – It manages the whole IoT system, including applications, business and profit models.

Emerging Technology for Engg. (KMC-101)

LO- Students will be able to understand applications of IOT in smart cities

Smart Cities and IoT - The new IoT applications are enabling Smart City initiatives worldwide. It provides the ability to remotely monitor, manage and control devices, and to create new insights and actionable information from massive streams of real-time data.

The main features of a smart city include a high degree of information technology integration and a comprehensive application of information resources. The essential components of urban development for a smart city should include smart technology, smart industry, smart services, smart mgmt and smart life.

The IoT is about installing sensors for everything and connecting them to the internet through

specific protocols for information exchange and communications, in order to achieve intelligent recognition, location, tracking, monitoring and management.

With the technical support from IoT, smart city need to have three features of being instrumented, interconnected and intelligent. Only then a smart city can be formed by integrating all these intelligent features at its advanced stage of IoT development.

The explosive growth of Smart City and internet of things applications creates many scientific challenges that call for ingenious research efforts from both academia and industry, specially for the development of efficient, scalable and reliable Smart City based on IoT.

Lecture-5 ABES IT college of engg. (290) Unit-1

Emerging Technology for Engg. (KMC-101)

Lo- Students will be able to understand applications of IOT in industries.

* Industrial Internet of Things - (IIOT) -

The Industrial Internet of things (IIOT) refers to the extension and use of the internet of things in industrial sectors and applications. With a strong focus on machine-to-machine (M2M) communication, big data and machine learning, the IIOT enables industries and enterprises to have better efficiency and reliability in their operations. The IIOT encompasses industrial applications, including robotics medical devices and software defined production processes.

The IIOT goes beyond the normal consumer devices associated with IoT. What makes it distinct is the intersection of information technology and operational technology.

The convergence of IT and OT provide industries with greater system integration in terms of automation and optimization, as well as better visibility of the supply chain and logistics. The monitoring and control of physical infrastructures in industrial operations, such as in agriculture, healthcare, manufacturing, transportation are made easier through the use of smart sensors as well as remote access and control.

By adopting connected and smart devices, businesses are enabled to gather and analyze greater amounts of data at greater speeds. Not only will this enhance scalability and performance, but it can also bridge the gap b/w the production floors and general offices. Integration of the IIOT can give industrial entities a more accurate view of how their operations are moving along and help them make improved business decisions.

AWS
AZURE
GOOGLE CLOUD PLATFORM
IBM CLOUD

AWS

- It is a secure cloud service avenue that offers computing power, database storage to help businesses grow and scale their offerings.
- AWS was first launched with a view to effectively handle its growing retail operations.
- It is first cloud company to introduce the pay as you go model.
- AWS can handle multiple services such as data management, hybrid cloud, big data management and more.
- AWS has 100 plus services in the directory with benefits like cost-effectiveness, flexibility, agility and security.

MICROSOFT AZURE

- It offers cloud services like analytics, storage, computing and networking.
- It has 3 models of services like SaaS, PaaS and IaaS.
- An open and flexible enterprise level platform faster to use.
- Azure primarily has 11 services that it offers to its clients.

GOOGLE CLOUD

- GCP began its journey in 2011.
- GCP is a suite of cloud computing services .
- GCP services runs on the same infrastructure that Google uses internally for its end user products such as Google Search Engine, You Tube and more.
- Now GCP introduced their enterprise services so that anyone can use GCP platform which shares the same infrastructure as that of Google Search Engine or You Tube.

COMPUTER SERVICES

Services	AWS	Azure	GCP
IaaS	Amazon Elastic Compute Cloud	Virtual Machines	Google Compute Engine
PaaS	AWS Elastic Beanstalk	App Service and Cloud Services	Google App Engine
Containers	Amazon Elastic Compute Cloud Container Service	Azure Kubernetes Service (AKS)	Google Kubernetes Engine
Serverless Functions	AWS Lambda	Azure Functions	Google Cloud Functions

DATABASE SERVICES

Services	AWS	Azure	GCP
RDBMS	Amazon Relational Database Service	SQL Database	Google Cloud SQL
NoSQL: Key–Value	Amazon DynamoDB	Table Storage	Google Cloud Datastore Google Cloud Bigtable
NoSQL: Indexed	Amazon SimpleDB	Azure Cosmos DB	Google Cloud Dat

STORAGE SERVICES

Services	AWS	Azure	GCP
Object Storage	Amazon Simple Storage Service	Blob Storage	Google Cloud Storage
Virtual Server Disks	Amazon Elastic Block Store	Managed Disks	Google Compute Engine Persistent Disks
Cold Storage	Amazon Glacier	Azure Archive Blob Storage	Google Cloud Storage Nearline
File Storage	Amazon Elastic File System	Azure File Storage	ZFS/Avere

NETWORK SERVICES

Services	AWS	Azure	GCP
Virtual Network	Amazon Virtual Private Cloud (VPC)	Virtual Networks (VNets)	Virtual Private Cloud
Elastic Load Balancer	Elastic Load Balancer	Load Balancer	Google Cloud Load Balancing
Peering	Direct Connect	ExpressRoute	Google Cloud Interconnect
DNS	Amazon Route 53	Azure DNS	Google Cloud DNS

COMPARISON

- **Establishment:** With a head start of 5 years, **the winner here is AWS.**
- **Availability zones:** With a greater number of regions and availability zones, **the winner here is AWS**.
- **Market shares:** With around one-third of market shares in its name, **the winner here is AWS.**
- **Growth rate:** Having a growth rate of almost 100 percent, **the winner is GCP.**
- **Who uses them:** With various high-end customers using all the three cloud platforms, **it's a tie!**
- **Services:**
  - When it comes to the number of services, **the winner is AWS.**
  - Regarding the integration with open-source and on-premise systems, such as MS tools, that are mostly used in almost all organizations, **the winner is Azure.**
- **Pricing Models:** With more customer-friendly pricing models and discount models, **the winner here is Google Cloud.**

IBM CLOUD

- It provides cloud services for businesses offered by the IT companies.
- It combines PaaS with IaaS.
- It supports both small organizations and large enterprises.

SERVICES:

- Bare Metal Server
- Kuberneetes server
- Watson Studio
- File Storage
- Cloudant
- Virtual Private Cloud

Thank you!!!!!!!

Lecture-9

Unit-3

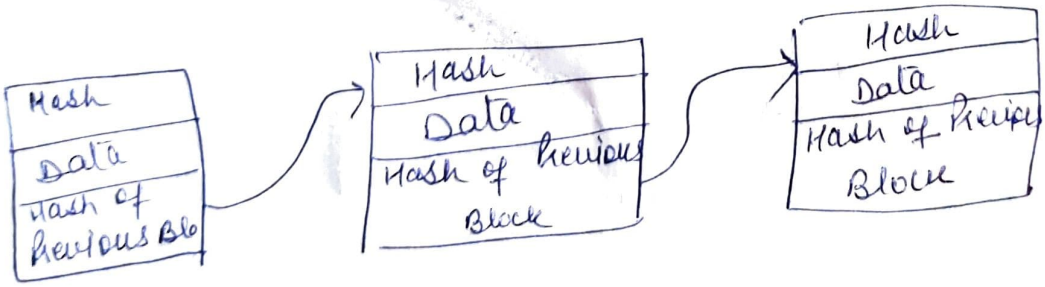
AGSIT College of Engg. (290).

Emerging Technology of Engg.

LO- Students will be able to understand the basics of Blockchain Technology.

What is Blockchain-

- Open, distributed ledger that can record transactions between two parties efficiently and in a verifiable and Permanent way.



How does a Blockchain Work-

(1) A user requests for a transaction.

(2) A block representing the transaction is created.

(3) The block is broadcasted to all the nodes of the network.

(4) All the nodes validate the block and the transaction.

(5) The block is added to the chain

(6) The transaction gets verified and executed.

Benefits of Blockchain Technology -

① **Immutable** - The transaction cannot be undone if they are already on the blockchain.

② **Shared and distributed** - Blockchain technology offers a shared and distributed ledger that is open for all users.

③ **Decentralized** - Not dependable on server based technology and no one has authority over the system.

④ **More secured** - Much safer than the traditional methods.

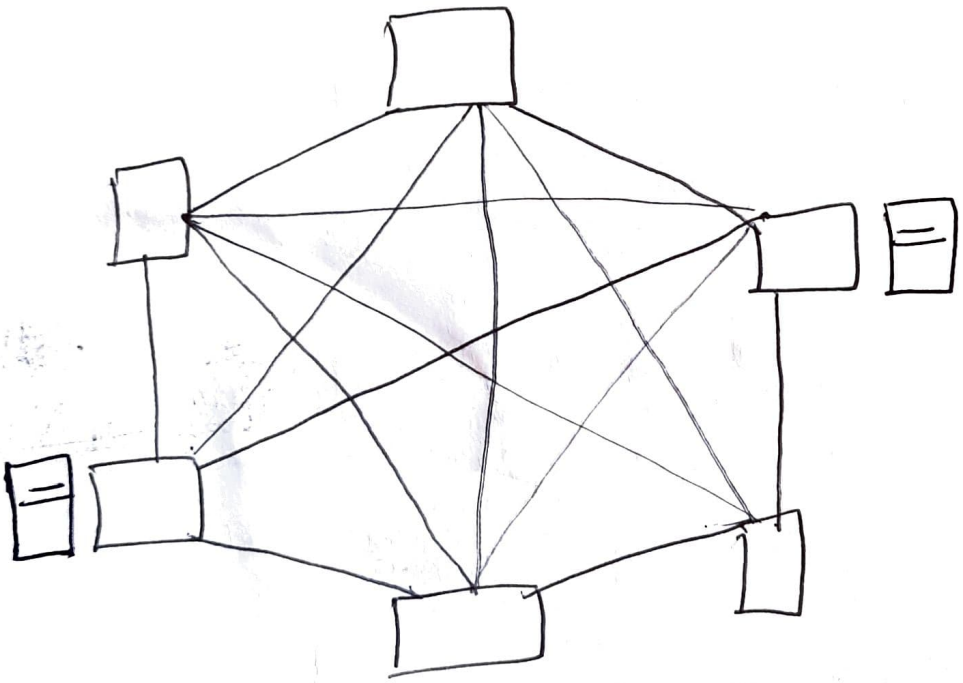
⑤ **Increase N/W capacity** - Much more capable than the traditional methods.

⑥ **Faster settlement** - Way faster than the manual process of validation.

Public & Private Blockchain Network -

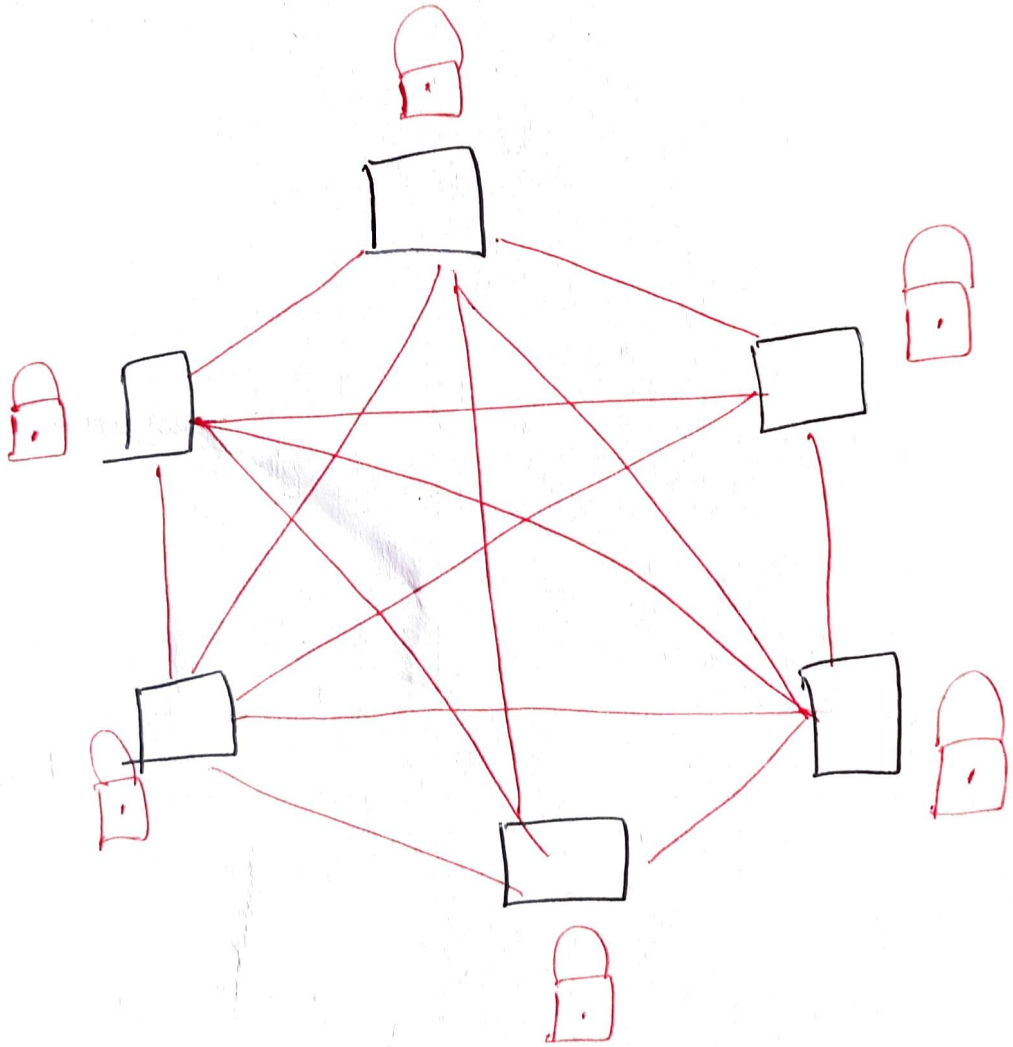
Public Blockchain - (Permissionless)

An open network system where all the devices can freely access without any kind of permission. The ledger is shared and transparent.



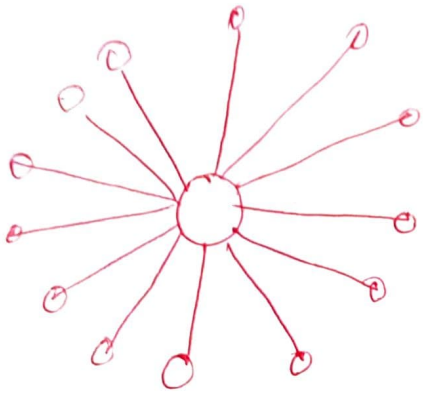
Private Blockchain – (Permissioned)

A user has to be permitted by the blockchain authority before he/she could access the n/w. The user might join only if he/she gets an invitation.

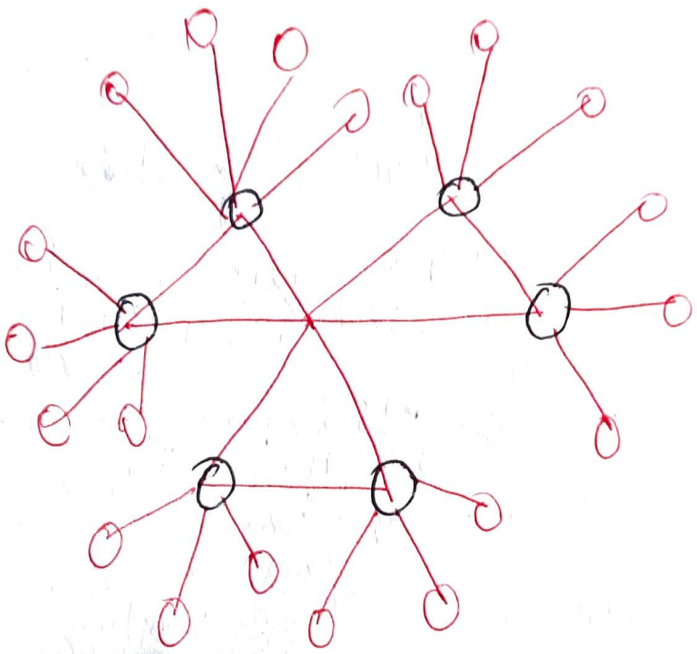


Centralized, Decentralized, Distributed N/W -

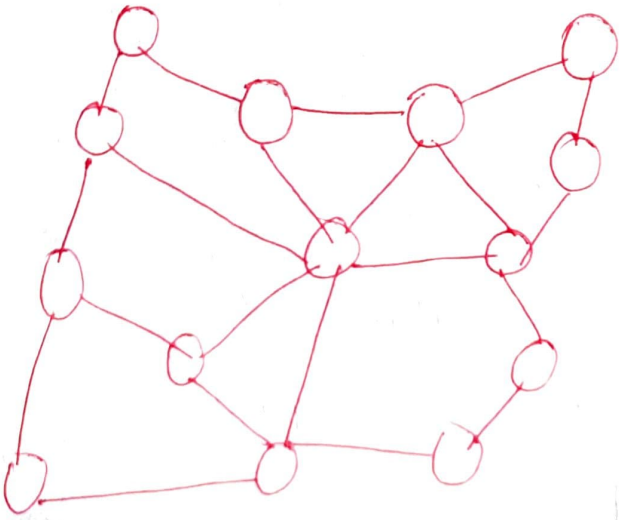
Centralized N/W - All the nodes are connected under a single authority.



Decentralized N/W – No single authority server control the nodes, they all have individual entity.



Distributed N/W - Every node is independent and interconnected with each other.



Lecture-9. Unit-3.

ABESIT college of engineering (290).

Emerging Technology of Engineering.

LO - Students will be able to know what is Cryptocurrency.

Cryptocurrency - Cryptocurrency is a digital asset designed to work as a medium of exchanged wherein individual coin ownership records are stored in a ledger existing in a form of computerised database using strong cryptography to secure transaction records, to control the creation of additional coins, and to verify the transfer of coin ownership. It typically does not exist in physical form (like paper money) and is typically not issued by a central authority.

Cryptocurrencies typically use decentralized control as opposed

to centralized digital currency and central banking systems. When a cryptocurrency is minted or created or issued by a single ~~issuer~~ Issuer, it is generally considered centralized. When implemented with decentralized control, each cryptocurrency works through distributed ledger technology, that serves as a public financial transaction database.

Bitcoin, first released as open-source software in 2009, is the first decentralized cryptocurrency.

Some other cryptocurrencies are as -

1. Litecoin
2. Tether
3. Bitcoin Cash
4. Libra
5. Monero etc.
6. ethereum etc.

ABESIT college of Engineering. (290)

Emerging Technology of Engg.

LO- Students will be able to know what is smart Contracts.

Smart Contracts- A smart contract is an agreement b/w two people in the form of computer code. They run on the blockchain, so they are stored on a public database and cannot be changed.

The transactions that happen in a smart contract are processed by the blockchain which means they can be sent automatically without a third party. This means there is no one to rely on.

The transactions only happen when the conditions in the agreement

are met, there is no third party, so there are no issues with trust. (like a bank, broker etc.)

Eg. → Smart contracts being used in the medical industry by EncrypGen.

This is an applⁿ that uses smart contracts to transfer patient data in a secure way, allowing no access for third parties.

→ Two insurance companies, Altas Insurance in Malta and Axa in France, tested smart contracts in 2017.

It can reduce fraud, delays and the overall cost of many things.

And the best thing about having no middleman is the fact that we save a lot of money.

ABESIT College of Engineering 1290.

Emerging Technology of Engineering.

LO - Students will able to know different applications of Blockchain.

Blockchain Use Cases -

- Blockchain is a digital, decentralized technology which maintains a record of all transactions which happen over a peer-to-peer network.

- These are the use cases of blockchain across various industry verticals -

(1) Supply Chain Management - The Supply chain is a network which is established b/w a business and its suppliers. Blockchain Promises to find a remedy to supply chain Problems through the

the digitization of assets. It allows for products to be tagged and assigned with unique identities which are then transplanted onto an immutable, transparent and secure blockchain. Blockchain helps in tracking important product information such as the state of the product, shelf life, time and location. Products can be accurately tracked across different locations and stages in a supply chain.

(2) Digital Voting - Blockchain offers the ability to vote digitally, but it's transparent enough that any regulators would be able to see it something were changed on the network. It combines the ease of digital voting with the immutability of bockchain to make your vote truly count.

(3) Real estate, land ~~and~~ title transfers -

One of the primary goals of blockchain is to take paper out of the equation, since paper trails are often a source of confusion. If you are buying or selling land, a house, or a car, you'll need to transfer or receive a title. Instead of handling this on paper, blockchain can store titles on its n/w, allow for a transparent view of this transfer, as well as presenting a crystal clear picture of legal ownership.

(4) Weapons Tracking - One of the hot-button topics on any news network at the moment is gun control / weapons accountability. Blockchain could create a transparent

and unchanging registry n/w that allows law enforcement and the federal govt. to track gun or weapon ownership, as well as keep a record of weapons sold privately.

(5). Copyright and Royalty Protection - In a world with growing internet access, copyright and ownership laws on music and other content has grown hazy. With blockchain, those copyright laws ~~should~~ would be buffed up considerably for digital content downloads, ensuring the artist or creator of the content being purchased gets their fair share. The blockchain would also provide real-time and transparent royalty distribution data to musicians and content creators.

Lecture - 12 Unit - 4.

ABES Institute of Technology (290).

Emerging Technology for Engineering (KHC-102)

3D - Printing

LO - Students will be able to know the technology of 3D printing.

1981 - 1999 :- The infancy of Additive Manufacturing

In, 1981, Hidio Kodama of Nagoya Municipal Industrial Research Inst. published his account of a functional rapid-prototyping system using Photopolymers (more on those in a minute). A solid, printed model was built up in layers, each of which corresponded to a cross-sectional slice in the model.

In 1984, Charles Hull made 3-D printing history by inventing Stereolithography.

Stereolithography lets designers create 3D models using digital data, which can then be used to create a tangible object.

The key to stereolithography is a kind of acrylic-based material known as photopolymer. Hit a vat of liquid photopolymer with a UV laser beam, and the light-exposed portion will instantly turn into solid piece of plastic, molded into the shape of your 3D-Model design.

In 1992, Bill Clinton played sax on The Arsenio Hall show - and 3D systems created the world's first stereolithographic apparatus machine, which made it possible to fabricate complex parts, layer by layer, in a fraction of the time it would normally take.

These technologies were in their infancy and weren't perfect; there was some warping in the material as it hardened, and the machines were prohibitively expensive

for home inventors, but their potential was undeniable.

1999 - 2010: 3D Printing's Adolescent History

- Wake Forest Inst. for Regenerative Medicine printed Synthetic scaffolds of a human bladder. and then coated them with the cells of human patients. The newly generated tissue was then implanted into the patients with little to no chance that their immune systems would reject them, as they were made of their own cells.

By the mid-2000's the democratization of manufacturing had captured the public's imagination, as had the idea of mass customization.

2011 – Present day: 3D Printing in its Prime – Beyond

jewelery and aircraft, 3D Printing is now being used to manufacture affordable housing for the developing world, and visionaries have begun to employ the technology to print everything from smart robotic arms, bone replacements and even particles just a few atoms thick.

3D - Printing -

3D - Printing or additive manufacturing is a process of making three dimensional solid objects from a digital file.

The creation of a 3D-printed object is achieved using additive processes. In an additive process an object is created by laying down successive layers of material until the object is created. Each of these layers can be seen as a thinly sliced cross-section of the object.

3-D Printing enables you to produce complex shapes using less material than traditional manufacturing methods.

3D Printing Process – It all starts with a 3D-Model.

→ 3D Software – There are many different software tools available.

Tinkercad is free and works in your browser; you don't have to install it on your computer. It has a built-in feature to export your model as a printable file.

Now, you have a printable file, the next step is to prepare it for your 3D-Printer. This is called slicing.

→ Slicing: From Printable file to 3D-Printer.

Slicing basically means slicing up a 3D-Model into hundreds or thousands of layers and is done with slicing software.

When your file is sliced, its ready for feeding the file to your 3D Printer. can be done via USB, SD or Wifi etc. Your sliced file is now ready to be 3D Printed layer by layer.

3-D Printing Technologies-

There are three broad types of 3D printing Technologies-

① Selective Laser Sintering (SLS)- Uses a high Power laser to fuse input materials like plastic, metal, glass etc. It scans the powdered material layer by layer.

② Fused Deposition Modeling (FDM)- It uses a plastic filament or metal wire as input material to an extrusion nozzle. The nozzle is heated to melt the

material and can be mould in both horizontal and vertical directions. The material hardens immediately after extrusion from the nozzle.

③ Stereolithography (SLA) – Photopolymerization is used to produce a solid part from a liquid. This technology employs a vat of liquid ultraviolet curable photo-polymer resin and an ultraviolet laser to build the object's layer one at a time. UV laser solidifying the pattern.

Principles of 3D Printing –

① **Reduction of Costs** – In traditional manufacturing, the more complicated an object's shape is, the more it costs to make. To produce an object of equal complexity, 3D Printing can remove the overhead costs associated with retooling factory machines.

② **No assembly is required** – 3D Printing can also print objects with its interlocked parts in one go. In factories, machines make identical objects that are later assembled by robots or workers. The more parts a product contains, the longer it takes to assemble and the more expensive it becomes to make. By

making objects in layers, a 3D Printer could Print a door with its attached interlocking hinges at the same time, with no assembly required. Supply chain will be shortened, while saving money on labor and transportation costs at the same time.

(3) Ability to Print on-demand — A 3D Printer can print on-demand when an object is required. The capacity for on-the spot manufacturing ~~requires~~ reduces the need for companies to stockpile physical inventory. This could also minimize the costs of long-distance shipping since the object required can be printed as long as a 3D-Printer is present.

(4) Portable Manufacturing — 3D Printers are generally lighter in weight and smaller in scale compared to traditional machines, users

can freely move them around anywhere to print 3D- objects.

⑤ Precise Physical Replication- Scanning technology & 3D Printing will work together to introduce high-resolution shape shifting b/w the physical and digital worlds. We will scan, edit and duplicate physical objects to create exact replicas or even improve upon the originals.

3D - Printing Use Cases -

→ Manufacturing and Engineering -

1. Automobiles.
2. Jewelry
3. Glasses & Eyewear
4. Shoes
5. Model Making.

→ Healthcare -

1. Audiology
2. Dentistry
3. Surgery
4. 3D Printed Organs.

Lecture -13 (Unit - 4)

ABES Institute of Technology (290).

Emerging Technology for Engineering (KHC-102)

DRONES.

LO- Students will be able to Know the various type of Drones and their applications.

DRONE -

→ Drone is an Unmanned Aerial Vehicle (UAV), known as Drone, is an aircraft without a human pilot.

→ DRONE stands for Dynamic Remotely Operated Navigation Equipment.

→ It's flight is either controlled by computer or under the remote control of a pilot on the ground.

Applications of UAV –

→ Search and Rescue
→ Disaster Relief
→ Commercial aerial surveillance
→ Commercial and Motion Picture filmmaking.
→ Armed attacks.

UAV's of India.

→ Lakshya PTA
→ DRDO Nishant
→ DRDO Rustom
→ Daksha
→ DRDO Aura
→ DRDO Netra
→ Ulka
→ Pawan UAV
→ Aero Dreamers.
→ ADE Nishant.

Nixie DRONE-

→ Nixie is a small camera equipped drone that can be worn as a wrist-band.
→ Nixie can be activated to unfold into a quadcopter, fly in one of its

Reprogrammed modes to take photos or a video, and then return to the user.

Advantages of Drones -

- → Does not contain, need a qualified pilot on board.
- → Can enter environments that are dangerous to human life.
- → Reduces the exposure risk of the aircraft operator.
- → Perform visual imaging of a region.

Disadvantages -

→ Can be hacked.
→ Too small for Transportation of materials.
→ Low resistance to weather.
→ Cannot refuel in flight.
→ If Contact is lost with the ground station, the vehicle may be lost.

Multirotor Drone Assembly Course / Regulations and procedures for Becoming a DRONE Pilot. –

→ Pilot must be at least 16 years of age.

→ Be able to read, speak, write and understand English.

→ Be in physical and mental condin. to safely fly a drone.

→ Pass the initial aeronautical knowledge exam, at an FAA approved testing centre.

→ Or They should hold a current Part 61 private pilot certificate or higher and complete an UAS online training course provided by the FAA (Federal Aviation Administration).

→ Valid for 2 yrs, certificate holders must pass a recurrent knowledge test after 2 yrs.

Lecture -14 (Unit-5)

ABES Institute of Technology (290)

Emerging Technology for engineering (KMC-102)

Virtual Reality

LO- Students will be able to know the concepts of Virtual Reality.

Virtual Reality - (VR) - Virtual Reality refers to a high end-user interface that involves real time simulation and interactions through multiple sensorial channels.

VR is able to immerse you in a computer generated world of your own making: a room, a city etc.

Brief History –

→ In 1950s, flight simulators were built by US Air force to train student Pilots.

→ In 1965, a research program for computer graphics called "The Ultimate Display" was laid out.

→ In 1988, commercial development of VR began.

→ In 1991, first commercial entertainment VR system "Virtuality" was released.

Types of VR system -

* Windows on world (WoW) -

→ Also called Desktop VR.
→ Using a conventional computer monitor to display the 3D virtual world.

* Immersive VR -

→ Completely immerse the user's personal viewpoint inside the virtual 3D world.
→ The user has no visual contact with the physical world.
→ Often equipped with a Head Mounted Display (HMD).

* Telepresence –

→ A variation of visualizing complete computer generated worlds.

→ Links remote sensors in the real world with the senses of a human operator. The remote sensors might be located on a robot. Useful for performing operations in dangerous environments.

* Distributed VR –

→ A simulated world runs on several computers which are connected over network and the people are able to interact in real-time, sharing the same virtual world.

Technologies of VR- Hardware.

* Head Mounted Display (HHD)

→ A helmet or a face mask providing the visual and auditory displays.
→ Use LCD or CRT to display stereo images.
→ May include built-in head-tracker and stereo headphones.

* Binocular Omni-Orientation Monitor (BOOM)

→ Head coupled stereoscopic display device.
→ Uses CRT to provide high-resolution display.
→ Convenient to use.

→ Fast and accurate built-in tracking.

* Cave Automatic Virtual Environment (CAVE) –

→ Provides the illusion of immersion by projecting stereo images on the walls and floor of a room-sized cube.
→ A head tracking system continuously adjust the stereo projection to the current position of the leading viewer.

* Data Glove –

→ Outfitted with sensors on the fingers as well as on overall position/ Orientation Tracking equipment.
→ Enables natural interaction with virtual objects by hand gesture recognition.

Technologies of VR – (Software)

* **Toolkits –**
  - → Programming Libraries.
  - → Provide function libraries.

* **Authoring Systems –**
  - → Complete programs with graphical interfaces for creating worlds without resorting to detailed programming.

* **Software Packages available in market –**
  - → Multiverse
  - → Virtual Reality Studio
  - → Sense 8 World Tool kit
  - → Autodesk Cyberspace Development kit.

* VRML (Virtual Reality Modeling Language) —

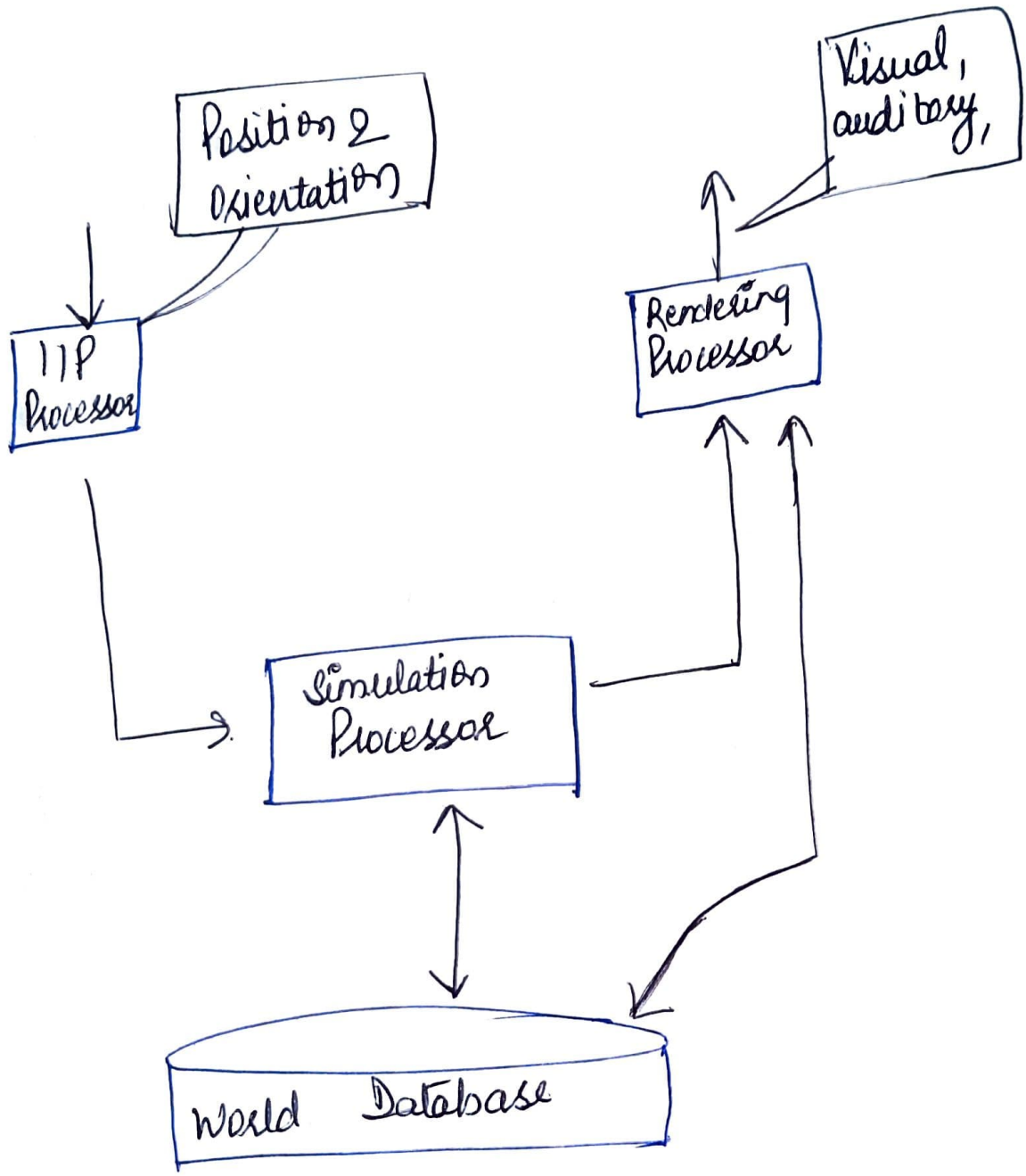
→ Standard language for interactive simulation within the WWW.

→ Allows to create "virtual worlds" networked via the internet and hyperlinked with the WWW.

→ Aspects of virtual world display, interaction and internetworking can be specified using VRML without being dependent on special gear like HMD.

→ VR models can be viewed by Netscape or IE with a browser plug-in.

Architecture of VR System -



Components of VR System -

* Input Processor -

→ Control the devices used to I/P information to the computer.
The object is to get the coordinate data to the rest of the system with minimal lag time.

→ keyboard, mouse, 3D position trackers, a voice recognition system etc.

* Simulation Processor -

→ Core of a VR System.

→ Takes the I/P from user along with any tasks programmed into the world and determine the actions that will take place in the virtual world.

* Rendering Processor –

→ Create the sensations that are O/P to the user.

→ Separate rendering processes are used for visual, auditory, and other sensory systems. Each renderer take a description of the world stat from the simulation process or derive it directly from the World Database for each time step.

* World Database –

→ Store the objects that inhabit the world, scripts that describe actions of those objects.

* Applications –

1. Entertainment
2. Medicine
3. Manufacturing
4. Education & Training.

* Current Problems & Future work –

→ Expensive
→ Lack of integration b/w application packages.

→ Cost - saving
→ Collaborative
→ High level contact between participants in distributed VR.

Lecture-15 (Unit-5)

ABES Institute of Technology (290)

Emerging Technology for Engineering (KMC-102)

Augmented Reality:

LO – Students will be able to know the concepts of Augmented Reality.

Augmented Reality –

→ Augmented Reality is a field of computer research which deals with the combination of real world and computer generated data.

→ Most of the AR research is currently concerned with the use of video imagery which is digitally processed and augmented by adding computer generated graphics.

→ Ronald Azuma defines an augmented reality system as one that:

* Combines real and virtual world aspects.
* Is interactive in real time.

How does AR work –

→ The basic idea of augmented reality is to superimose graphics, audio & other sense enhancements over a real-world environment in real-time.

→ The graphics will then change to accomodate the user's eye or head movements.

What is needed –

→ There are three components needed in order to make an augmented reality system work:

* Head mounted display
* Tracking system
* Mobile computing power.

Current Uses of AR –

→ HUD (Head up Display) –

* Uses in commercial aircraft, automobiles and other appli?
* Presents data without requiring the user to look away from his or her usual viewpoint.

Life Clipper –

→ Life Clipper is a wearable AR system being used in Switzerland.

→ When walking around a chosen culturally interesting area, the user will feel as ~~though~~ though they are watching a film.

Wikitude – AR Travel Guide –

→ Mobile travel guide for the Android platform.

→ Plan a trip or find about current surroundings in real-time.

Future of AR-

→ Military -

* The office of Naval Research has sponsored AR research.
* AR system could provide troops with vital info about their surroundings.

→ Medical -

* Superimpose an image from an MRI into a patient's body.
* This might allow surgeons to pinpoint a tumor to remove.

→ Education -

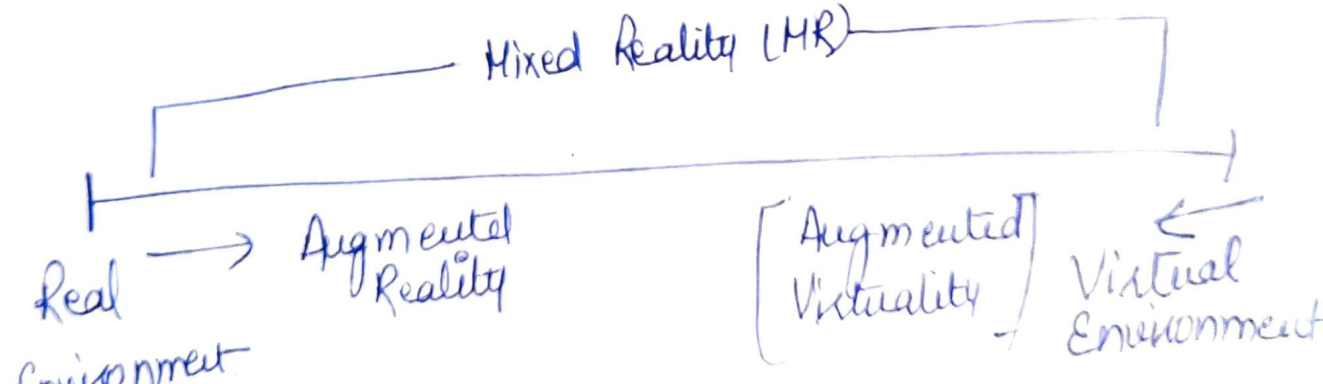
* Used in labs where students can learn more about the experiments they are participating in.

Augmented Vs Virtual Reality –

→ One of the identifying marks of a virtual reality system is the head mounted display worn by users

→ These displays block out all the external world and present to the wearer a view that is under the complete control of the computer.

→ In AR, the user must still be aware that he or she is present in the "real world."



(Unit-5)

Lecture - 16

ABES Institute of Technology (290).

Emerging Technology for Engineers

LO - Students will be able to know about - 5G Technology.

5G Technology

Introduction -

→ It is 5th generation wireless Technology.

→ Complete wireless communication with almost no limitations.

→ Can be called REAL wireless world.

→ Has incredible transmission speed.

It offers -

→ World wide Cellular phones.
→ Extraordinary data capabilities.
→ High Connectivity
→ Large Phone memory, more dialing speed, more clarity in audio & video.
→ More power & features in hand held phones.

Evolution of Generations -

1G
↓
2G
↓
3G
↓
4G
↓
5G
↓

1G (1st Generation).

→ Developed in 1980's and completed in early 1990's.

→ Based on analog system.

→ Speed up to 2.4 kbps.

→ AMPS (Advance Mobile Phone System) was launched by the US and it was the 1G Mobile System.

→ Allows user to make voice calls in 1 country.

2G (2nd Generation)

→ Developed in late 1980s and completed in late 1990s.

→ Based on digital system.

→ Speed up to 64 kbps.

→ Services such as digital voice and SMS with more clarity.

→ Gmi Global facility

→ 2G are the handsets (2.5G) having more capabilities.

3G (3rd Generation).

→ Developed between late 1990s and early until present day.

→ Transmission speed from 125 kbps to Mbps.

→ Superior voice quality.

→ Good clarity in video conferencing.

→ E-mail, PDA, information surfing, On-line shopping / banking.

→ Global Roaming.

4G (4th Generation)–

→ Developed in 2010
→ Faster and more reliable.
→ Speed up to 100 Mbps.
→ High Performance
→ Easy Roaming
→ Low cost.

5G (5th Generation)–

→ 10 times more capacity
→ Expected speed up to 1 GbPS.
→ Lower cost than Previous.
→ More faster and reliable - than 4G.
→ Next major phase of mobile telecommunication and wireless system.

Layered Architecture -

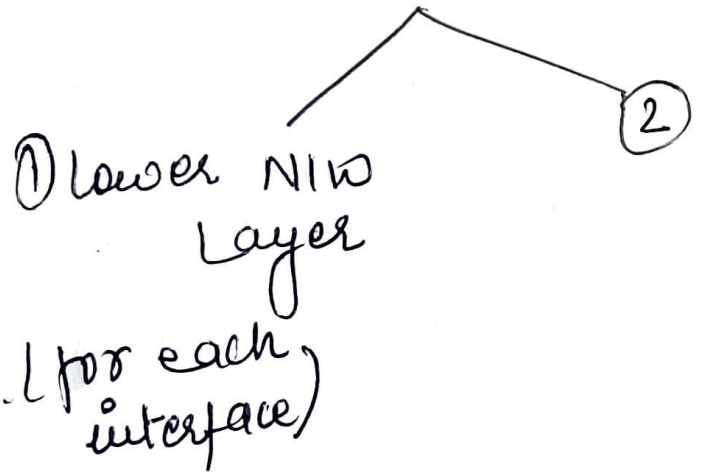
<table>
<tr><td>Application layer</td><td rowspan="2">Application (service)</td></tr>
<tr><td>Presentation layer</td></tr>
<tr><td>Session layer</td><td rowspan="2">Open Transport Protocol (OTP)</td></tr>
<tr><td>Transport layer</td></tr>
<tr><td rowspan="2">Network layer</td><td>Upper N/W layer</td></tr>
<tr><td>Lower N/W layer</td></tr>
<tr><td>Data link layer</td><td rowspan="2">Open Wireless Architecture (OWA).</td></tr>
<tr><td>Physical layer</td></tr>
</table>

* Open Wireless Architecture (OWA)

→ Physical layer + Data link layer = OWA

→ for these two layers the 5G mobile network is likely to be based on OWA.

* Network layer-



→ A mobile can be attached to several mobiles or wireless networks at the same time.

* Open Transport Protocol (OTP)

→ Transport layer + Session layer = OTP.

→ 5G mobile terminals have transport layer that is possible to be downloaded and installed — Open Transport Protocol (OTP).

* Application (Service) Layer —

→ Presentation layer + Application layer = Application.

→ Provides intelligent QoS (Quality of Service) management over variety of networks.

* Features of 5G.

→ High resolution for crazy cell phone users.
→ Bi-directional large BW.
→ Less traffic
→ 25 MbPS connectivity speed.
→ Uploading and downloading speed of 5G touching the peak (up to 1 GbPS).
→ Better and fast solution.
→ High quality service based on policy to avoid error.
→ More attractive and effective.

* Advantages of 5G.

→ Data BW of 1 GBPS or higher.
→ Globally Accessible
→ Available at low cost.

* Applications of 5G.

→ Wearable devices with AI.
→ Global networks
→ Radio resource management
→ Voice over IP (VoIP) enabled devices.

* Conclusion –

→ 5G → user centric
→ The new coming 5G technology will be available in the market at affordable rates, high peak future & much reliability than preceding technologies.

Lecture - 17 (Unit - 5)

ABES Institute of Technology (290).

Emerging Technology for Engg. (KHC-102)

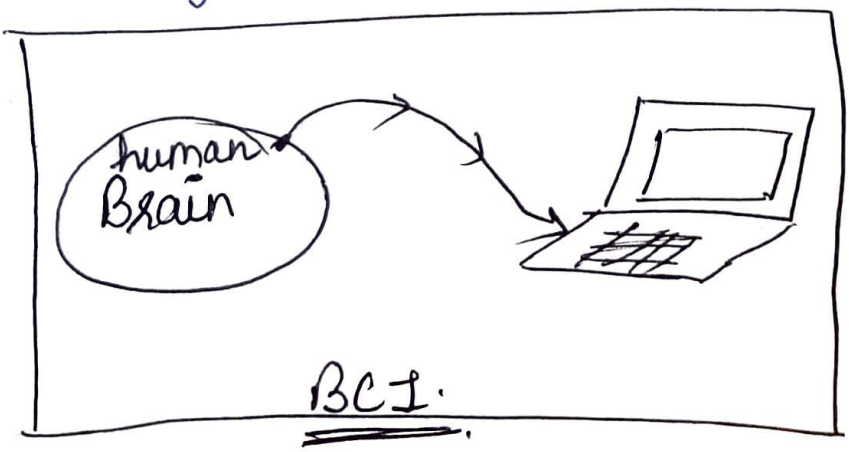
Brain Computer Interface

LO- Students will be able to know the Brain Computer Interface.

- BCI (Brain Computer Interface) -

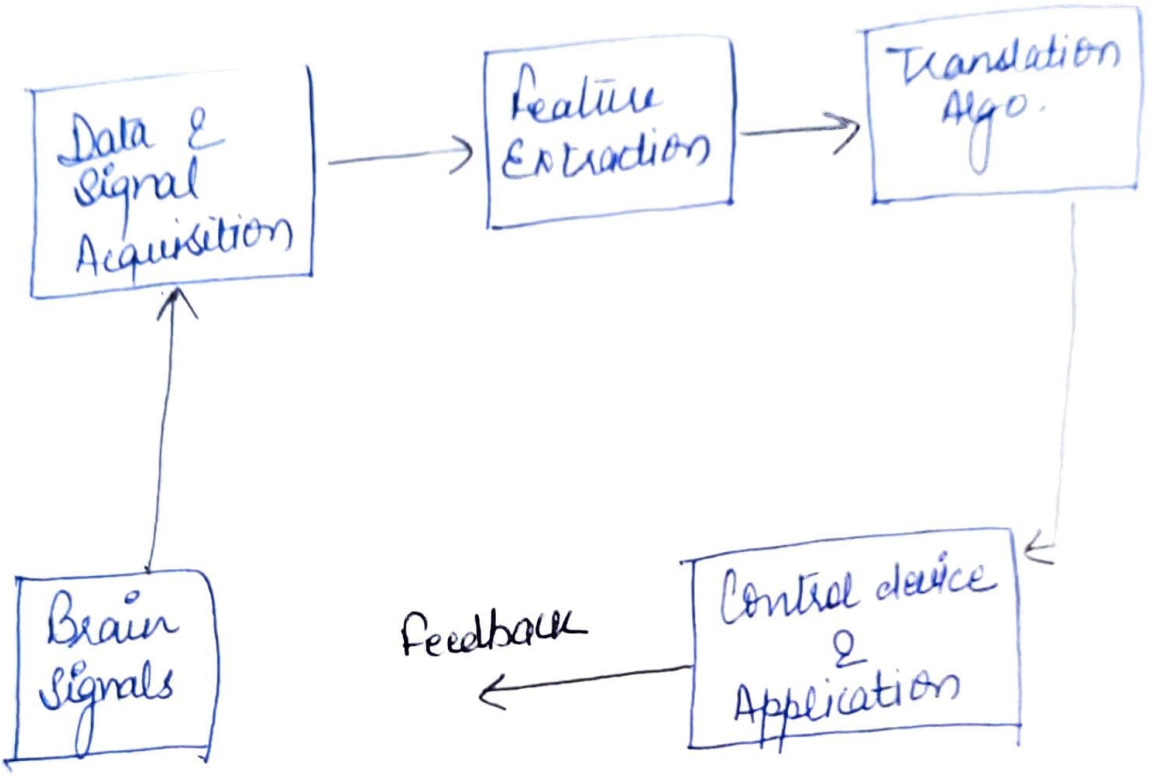
→ Direct Neural Interface.
→ Brain Machine Interface.
→ Direct comm^{n} pathway b/w a brain and a external device.

- → Research on BCI began in 1970's at the University of California Los Angeles.



BCI.

How Does it Work-



Types of BCI -

→ Invasive BCI
→ Non - Invasive BCI
→ Partial Invasive BCI.

Invasive BCI -

→ Invasive types of BCI are implanted directly into the brain during a neurosurgery.
→ Highest quality signals.
→ Provide functionality to paralyzed people.

Non- Invasive BCI -

→ Gives a patient the ability to move muscle implants and restore partial movement.

Partially Invasive BCI -

Partially Invasive BCI devices are implanted inside the skull but out of the brain.

Drawbacks -

- → Headache
- → Exhausting
- → Laziness.

Applications -

- → Medicine (Medical Industry).
- → Military
- → for deaf and dumb people.

Future -

→ Nursing and Medical treatment-

→ Newly purchased computers will one day arrive with biological signal sensors and thought recognition software built-in, just as keyboard and mouse are commonly found on today's units.