UNIT I FUNDAMENDALS OF IOT

Definition and Characteristics of IoT, Sensors, Actuators, Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Embedded Systems, IoT Levels and Templates, Domain Specific IoTs – Home, City, Environment, Energy, Agriculture and Industry.

IoT enabled Technologies

It is enabled by several Technologies including wireless sensor networks, cloud computing big Data Analytics, embedded system, security protocols and architectures, communication protocols, web service, mobile internet and semantic search engine.

Wireless sensor network

Wireless sensor network (wsn) comprises of distributed devices with the sensor which are used to monitor the environmental and physical conditions. A WSN consists of a number of end nodes and routers and a coordinator. End nodes have several sensors attached to them. End node can also act as a router. Routers are responsible for routing the data packet from end nodes to the coordinator. The coordinator node collects the data from all the notes coordinator also act as a Gateway that connects the WSN to the internet. IoT systems are described as follows ·

- Weather monitoring system using WSN in which the nodes collect temperature, humidity and other data which is aggregated and analysed.
- Indoor air quality monitoring system using WSN to collect data on the indoor air quality and connections of various gases.
- Soil moisture monitoring system using WSN to monitor soil moisture at various location. Surveillance systems use WSN for collecting surveillance data (motion detection data)
- Smart grid uses wireless sensor network for monitoring the grid at various point.
- Structural health monitoring systems use WSN to monitor the health of structure by writing vibration data from sensor nodes deployed at various points in the structure.

Cloud computing:

Cloud Computing is a transformative computing paradigm that involves delivering applications and services over the internet. Cloud Computing involves provisioning of computing networking and storage resources on demand and providing these resources as metered services to the users, in a "pay as you go" model. cloud Computing resources can be provisioned on demand by the user without requiring interactions with the Cloud Service Provider.

The process of provisioning resources used automatic Cloud Computing resources can be accessed then it worked using standard access mechanism that provide platform-independent access

through the use of heterogeneous client platforms such as workstations laptops tablets and Smartphones the computing and storage resources provided by Cloud Service Provider our food to serve multiple users using multi-Tenancy. Multi-tenant aspects on the multiple users to be served by the same physical hardware.

Cloud Computing services are offered to user in different forms

Infrastructure as a service (IAAS):

IaaS provides the user the ability provision computing and storage resources. These resources are provided to the users as virtual machine instances and virtual storage. Users can start, stop configure and manage the virtual machines instance on the virtual storage using can deploy operating systems and applications on their choice on the actual resources provisions in the cloud. Cloud Service Provider manages the underlying infrastructure.

Platform as a service (PaaS):

platform as a service provides the user the ability to develop and deploy application in the cloud using the deployment tool application programming interfaces API, software libraries and services provided by the Cloud Service Provider. The Cloud Service Provider manages the underlying cloud infrastructure including servers, network, operating systems and storage.

Software as a service (SaaS):

Provide the user a complete software application of the user interface to the application itself. The Cloud Service Provider manage the underlying cloud infrastructure including server, network storage and application software, and the user is unaware of the underlying architecture of the cloud. Applications are provided to the user through a thin client interface example Browser application. SaaS applications are accessed from various client smartphones running different operating system.

Big Data Analytics

Big data is defined as collections of data set whose volume, velocity in terms of its temporal variations) or variety, is so large that it is difficult to store, manage, process and analyze the data using traditional database and data processing tools. Big Data Analytics involving several steps starting from Data cleaning data munging data processing and visualization.

Some examples of big data generated by IoT systems are described as follows 1. Sensor data generated by IoT system such as weather monitoring stations 2. Machine sensor data collected from sensor embedded in Industrial and energy system for monitoring their files and protecting failure 3. Health and fitness data generated by IoT devices such as wearable fitness band. 4. Data generated by IoT system for Location tracking of vehicle. 5. Data generated by retail inventory monitoring system.

Characteristics of data include:

Volume: Through there is no fixed threshold for volume of data to be considered as big data, however

the term big data is used for massive scale data that is difficult to store, manage and process using traditional data bases and data processing architecture. The volume of data generated by modern IT, industrial and Healthcare systems for example is a growing exponentially driven by the lowering cost of data storage and processing architectures and the need to extract valuable insights from the data to improve business processes, efficiency and services to consumer.

Velocity: Velocity is another important characteristic of big data and the primary reasons for exponential growth of data velocity of the data of a store how fast the data is generated and how frequently it varies. Modern IT Industrial and other systems are generating data at increasing the highest speeds.

Variety: Variety refers to the forms of the data. Big data comes in for different forms such as structured or unstructured data including text data, audio, video and sensor data.

Communications protocol:

Communications protocols form the backbone of IoT system and enable network connectivity and coupling to applications. Communications protocols allow device to exchange data over the network. These protocols define the data exchange formats and data encoding schemes for devices and routing of packets from source to destination. Other function of the protocol include sequence control flow control and transmissions of Lost packet.

Embedded systems

An Embedded system is computer system that has computer hardware and software embedded perform specific task. In contrast to general purpose computers or personal computers which can perform various types of tasks, embedded systems are designed to perform a specific set of tasks. Embedded system includes Microprocessor and Microcontroller memory Ram ROM cache networking units (Ethernet WI-FI adaptor) input/output unit display keyboard, display and storage such as Flash Memory some embedded system have specialist processes such as digital signal processor DSP graphic processor and application.