

IoT Enabling Technologies

The technologies which are cooperative with IoT those are as follows.

- Wireless sensor networks
- Cloud computing
- Big Data analytics
- Embedded systems
- Communication protocols

Wireless Sensor networks:

1. Wireless sensor network comprises of distributed devices, wireless sensors. These devices with sensors are used to monitor the environment and physical conditions. Since all the nodes are wireless so they communicate with each other through wifi or Bluetooth.
2. A WSN consists of several end nodes and routers as well as coordinator.
3. Sensors are attached with end nodes. Each router can also be called as end node.
4. Routers are responsible for routing the data packets from end nodes to the coordinator nodes. Coordinator node connects the WSN to the internet. The Coordinator node can be another arduino, raspberry pi or any other IoT DIY device.
5. It collects the data from all the nodes.
6. WSNs are enabled by wireless communication protocols such as IEEE802.15.4.
7. It can also be enabled by ESP 8266 and ZigBee.
8. ZigBEE Bluetooth module is based on IEEE802.15.4. It operates at 2.4 GHz frequency. It offers data rate up to 250 KB/s and ranges from 10 to 100 meters depending upon power output and environmental conditions. In WSN the devices can reconfigure themselves i.e new nodes can be added to the networks and software can be updated automatically whenever they will be connected to the internet.
9. Ex. of Wireless sensor network: Weather monitoring system, Indoor air quality monitoring, soil moisture monitoring, surveillance system, smart grids, machine prognosis and diagnosis.

Cloud Computing:

1. It is an emerging technology which enables on-demand network access to computing resources like network servers, storage, applications and services that can be rapidly provisioned and released.

2. On demand: we invoke cloud services only when we need them, they are not permanent part of IT infrastructure.

3. Pay as you go model: You pay for the cloud services when you use them, either for the short period of time or longer duration (for cloud based storage).

4. Cloud provides various services such as

i. IAAS: Infrastructure as a service

Instead of creating a server room we will hire it from a cloud service provider. Here user will not use its local computer, storage and processing resources rather it will use virtual machine and virtual storage, servers, networking of third party. Here the client can deploy the OS (operating system), application of his own choice. User can start, stop, configure and manage the virtual machine instances and virtual storage.

ii. PAAS: Platform as a service

User can develop and deploy applications. For ex. We are using various online editors to write codes like online arduino IDE, C IDE, APIs, software libraries. Here we don't need to install anything. The cloud service provider will manage servers, network, OS and storage. The users will develop, deploy, configure and manage applications on the cloud infrastructure.

iii. SAAS: Software as a service

It provides complete software application or the user interface to the application itself. The user is not concerned about the underlying architecture of cloud only service provider is responsible for this. It is platform independent and can be accessed from various client devices such as workstation, laptop, tablet and smart phone, running different OS. Ex: The online software we use like online image converter, doc converter etc.

Big data analytics:

Big data refers to large amount of data which cannot be stored, processed and analysed using traditional database like (oracle, mysql) and traditional processing tools. In big data analytics BIG refers to 5 Vs.

- Volume
- Velocity
- Variety
- Veracity
- Value

Volume: volume refers to the massive amount of data generated from the IoT systems. There is no threshold value for generated data. It is difficult to store, process and analyse using traditional database and processing tools. Ex: The volume of data generated by modern IT, industrial and healthcare system.

Velocity: The rate at which the data is generated from the IoT system. This is the primary reason for the exponential growth of data. Velocity refers to how fast the data is generated and how frequently it varies. Ex: Modern IT, industrial and other systems like social networking sites are generating data at increasingly higher speed.

Variety: Variety refers to different forms of data. Since there is various domain of IoT so various type of data is generated from different IoT domain. Those data are called as sparse data. Those data include text, audio, video etc.. The variety of data is mainly divided into 3 types i.e.

- structured
- semi structured
- unstructured

Structured data: The data which has a fixed format to be stored is known as structured data. The data stored in database like oracle, mysql is an example of structured data. With a simple query data can be retrieved from the database.

Semi-structured data: The data which has not a fixed format to be stored but uses some elements and components through which they can be analyzed easily is known as semi structured data. Ex: HTML, XML, JSON data

Unstructured data: The data which has not any fixed format. It is difficult to store and analyse. It can be analyzed after converting into structured data. Ex: Audio, video (gif, audio with lyrics), Text (containing special symbols).

Veracity: The data in doubt is known as veracity. Sometimes what happen it is very difficult accept the data stored in database. This happens due to typical error, corrupted storage or data.

Value: It is efficient to access big data if we can turn it into values i.e we can find greater insights from it so that we can perform some action to get the desired output. This will be beneficial for the organisation. Otherwise it has no use.

Embedded Systems:

- An embedded system is a computer system that has hardware and software embedded to perform specific task.
- The key components of an embedded system include microprocessor or micro controller, memory (RAM, ROM, Cache), networking units (Ethernet, Wi-Fi adapter), input/output units (display, keyboard, etc) and storage (flash memory). They use some special types of processor such as digital signal processor, graphics processor and application specific processor). Embedded system uses embedded OS like RTOS.
- Ex. of embedded systems: digital watch, digital camera, vending machines.

Communication protocols:

- Protocol is nothing but rules and regulations. Communication protocol is the backbone of the IoT system.
- It allows interoperability among various devices. It enables network connectivity and coupling to applications.
- It allows devices to exchange data over the network. These protocols define data exchange format, data encoding, addressing schemes for devices and routing of packets from source to destination. It also includes sequence control, flow control and retransmission of lost packets.