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IOT TECHNOLOGIES

IoT primarily exploits standard protocols and networking technologies. However, the major enabling technologies and protocols of IoT are RFID, NFC, low-energy Bluetooth, low-energy wireless, low-energy radio protocols, LTE-A, and WiFi-Direct. These technologies support the specific networking functionality needed in an IoT system in contrast to a standard uniform network of common systems.

1. NFC and RFID

RFID (radio-frequency identification) and NFC (near-field communication) provide simple, low energy, and versatile options for identity and access tokens, connection bootstrapping, and payments.

- RFID technology employs 2-way radio transmitter-receivers to identify and track tags associated with objects.
- NFC consists of communication protocols for electronic devices, typically a mobile device and a standard device.

2.Low-Energy Bluetooth

This technology supports the low-power, long-use need of IoT function while exploiting a standard technology with native support across systems.

3.Low-Energy Wireless

This technology replaces the most power hungry aspect of an IoT system. Though sensors and other elements can power down over long periods, communication links (i.e., wireless) must remain in listening mode. Low-energy wireless not only reduces consumption, but also extends the life of the device through less use.

4. Radio Protocols

ZigBee, Z-Wave, and Thread are radio protocols for creating low-rate private area networks. These technologies are low-power, but offer high throughput

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unlike many similar options. This increases the power of small local device networks without the typical costs.

5.LTE-A

LTE-A, or LTE Advanced, delivers an important upgrade to LTE technology by increasing not only its coverage, but also reducing its latency and raising its throughput. It gives IoT a tremendous power through expanding its range, with its most significant applications being vehicle, UAV, and similar communication.

6.WiFi-Direct

WiFi-Direct eliminates the need for an access point. It allows P2P (peer-to-peer) connections with the speed of WiFi, but with lower latency. WiFi-Direct eliminates an element of a network that often bogs it down, and it does not compromise on speed or throughput.

7.Wireless Sensor Network(WSN) :
A **WSN** comprises distributed devices with sensors which are used to monitor the environmental and physical conditions. A **wireless sensor network** consists of end nodes, routers and coordinators. End nodes have several sensors attached to them where the data is passed to a coordinator with the help of routers. The coordinator also acts as the gateway that connects WSN to the internet.
Example –
* Weather monitoring system
* Indoor air quality monitoring system
* Soil moisture monitoring system
* Surveillance system
* Health monitoring system

Cloud Computing :
It provides us the means by which we can access applications as utilities over the internet. Cloud means something which is present in remote locations.
With Cloud computing, users can access any resources from anywhere like databases, webservers, storage, any device, and any software over the

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internet.
Characteristics –
1. Broad network access
2. On demand self-services
3. Rapid scalability
4. Measured service
5. Pay-per-use

Provides different services, such as

- **IaaS (**Infrastructure as a service**)**
  Infrastructure as a service provides online services such as physical machines, virtual machines, servers, networking, storage and data center space on a pay per use basis. Major IaaS providers are Google Compute Engine, Amazon Web Services and Microsoft Azure etc.
  Ex : Web Hosting, Virtual Machine etc.
- **PaaS (**Platform as a service**)**
  Provides a cloud-based environment with a very thing required to support the complete life cycle of building and delivering West web based (cloud) applications – without the cost and complexity of buying and managing underlying hardware, software provisioning and hosting. Computing platforms such as hardware, operating systems and libraries etc. Basically, it provides a platform to develop applications.
  Ex : App Cloud, Google app engine
- **SaaS (**Software as a service**)**
  It is a way of delivering applications over the internet as a service. Instead of installing and maintaining software, you simply access it via the internet, freeing yourself from complex software and hardware management.
  SaaS Applications are sometimes called web-based software on demand software or hosted software.
  SaaS applications run on a SaaS provider's service and they manage security availability and performance.
  Ex : Google Docs, Gmail, office etc.

8. Big Data Analytics :
It refers to the method of studying massive volumes of data or big data. Collection of data whose volume, velocity or variety is simply too massive and tough to store, control, process and examine the data using traditional databases.
Big data is gathered from a variety of sources including social network

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videos, digital images, sensors and sales transaction records.
Several steps involved in analyzing big data –
1. Data cleaning
2. Munging
3. Processing
4. Visualization
Examples –

- Bank transactions
- Data generated by IoT systems for location and tracking of vehicles
- E-commerce and in Big-Basket
- Health and fitness data generated by IoT system such as a fitness bands

9. Communications Protocols :

They are the backbone of IoT systems and enable network connectivity and linking to applications. Communication protocols allow devices to exchange data over the network. Multiple protocols often describe different aspects of a single communication. A group of protocols designed to work together is known as a protocol suite; when implemented in software they are a protocol stack.
They are used in
1. Data encoding
2. Addressing schemes

10. Embedded Systems :

It is a combination of hardware and software used to perform special tasks.
It includes microcontroller and microprocessor memory, networking units (Ethernet Wi-Fi adapters), input output units (display keyword etc.) and storage devices (flash memory).
It collects the data and sends it to the internet.
Embedded systems used in
Examples –
1. Digital camera
2. DVD player, music player
3. Industrial robots
4. Wireless Routers etc.