# Introduction to Internet of things

Assignment -1

**Q1. Explain IoT and its applications in detail.**

Ans1. Internet of things is an ecosystem, consisting of interrelated web-enabled smart computing devices, such as processors, digital and mechanical machines, sensors, and hardware used for communication. They are provided with unique identifiers, that aid in collecting and acquiring data from their respective environment. IoT devices, share sensor data which is sent on the cloud, to be analyzed.

IoT aids multinational companies to automate processes and mitigate labor costs. It makes the manufacturing of products less expensive and offers transaction transparency to customers.

Applications of IoT:

1. IoT helps farmers in agriculture by making their job easier. Sensors can collect data on rainfall, humidity, temperature, and soil content, as well as other factors, that would help automate farming techniques. A greenhouse enables us to control the climate inside it. Sensors measure different parameters according to the plant requirement and send them to the cloud. It processes the data and applies an instant control action.
2. Smart Cities- Palo Alto, San Francisco, realized, most cars on the streets go around the same block, in search of parking spaces, causing traffic congestion in the city. Thus, sensors were installed at all the parking spots around the city. These sensors pass the occupancy status of each spot to the cloud. Any number of applications can consume that data. It can also guide the drivers through the shortest route to an open spot.
3. Healthcare- IoT applications can turn reactive medical-based systems into proactive wellness-based systems. The resources that current medical research uses, lack critical real-world information. It mostly uses remaining data, controlled environments, and volunteers for medical examination. IoT opens ways to a sea of valuable data through analysis, real-time field data, and testing. It improves the power, precision, and availability of current devices.
4. Smart Home-  Jarvis*,* is an example of an AI home automation employed by Mark Zuckerberg. There is also Allen Pan’s Home Automation System where functions in the house are performed by use of a string of musical notes.
5. Wearables- They are devices embedded with sensors and software. They gather information, which later, extracts useful facts about the user. It majorly covers fitness, health, and entertainment domains. It is efficient and low in power.

**Q2 Explain the following:**

1. **Asset Management**
2. **IoT Telemetry**
3. Asset Management- An asset is intended to generate, for that it needs to be in a running condition. When an asset tracking plan is executed, it is crucial to keep a clear picture of assets so that compatible plans can be made.Asset management refers to the process of developing, operating, maintaining, and selling assets in a cost-effective manner. Most commonly used in finance, the term is used in reference to individuals or firms that manage assets on behalf of individuals or other entities.Every company needs to keep track of its assets. That way, its stakeholders will know which assets are available to be employed to provide optimal returns. The assets owned by any business fall into two main categories: fixed and current assets. Fixed or non-current assets refer to assets acquired for long-term use, while current assets are those that can be converted into cash within a short amount of time

**Optimization-**

IoT-enabled asset management takes the help of **sensors**. This empowers and strengthens organizations to know their assets' information, mitigating the need for human effort. The sensors attached to the asset are used to manufacture data and the same is relayed to the Cloud platform. . In case it is not working efficiently, preventive and [predictive maintenance](https://www.assetinfinity.com/blog/asset-maintenance-types-benefits-drawbacks) needs to be implemented for asset optimization. It saves expenses and extends the lifespan of an asset.

**Cost Tracking-**

The source, from where the cost originated is of utmost importance. Without which it gets difficult to lower expenses. For example, if the Maintenance Manager is not aware of the main problem of an asset, they cannot make the right and timely move to keep the asset in operation. IoT-empowered assets furnish information arising from the root. It ensures that the issues are resolved, breakdown costs are saved and smart financial decisions can be taken in time.

**Monitoring Maintenance and Security**

An enterprise can monitor an asset. An IoT sensor can alert managers when the operating parameters of assets such as temperature or environment are not in the permissible range. The IoT tracker takes the help of bank-level AES-256 data authentication and data encryption to ensure that the data is kept private and secure.

1. **IoT Telemetry**

It is the heart of Internet of things. It is a way of collecting data from sensors and remote places and transmitting it to receiving systems for analysis, monitoring, and various other things.

Data collected by the device is called telemetry. This is the eyes-and-ears data that IoT devices provide to applications. Telemetry is read-only data about the environment, usually collected through sensors.Each source of telemetry results in a channel. Telemetry data might be preserved as a stateful variable on the device or in the cloud.Although each device might send only a single data point every minute, when you multiply that data by a large number of devices, you quickly need to apply big data strategies and patterns.

Rising IoT is bringing a market revolution. One of the biggest use cases for IoT is telemetry. Some of the technologies converging to drive IoT market growth include:

* Battery technologies that can power IoT and network communications for 10 or more years of the device’s life without recharging
* Miniaturization of hardware and embedded systems capable of complex applications.
* Artificial intelligence and machine learning data analysis

**IoT Telemetry Network Architecture**

* **IoT Devices –** IoT devices are independent network nodes that communicate across IP networks or often directly with IoT gateway systems.
* **M2M IoT –** Protocols communicate with the local IoT gateway or alternately with a central data center or cloud locations.
  + **IoT Gateway –** the intelligent IoT gateway performs a set of functions including, Protocol translation between M2M IoT protocols and central data center and cloud applications. Consolidation of upstream IoT communications to WAN-optimized data communications. Near real-time analytics and event management. IoT devices
* **IoT Edge Security –** IoT devices are exposed and vulnerable. IoT devices that have been compromised should be detected and quarantined as soon as possible. Edge security for IoT devices should be provided both at the IoT gateway and at the ingestion point of the central data centers or clouds.
* **Datacenter –** IoT data ingested is often processed by: Business applications that monitor and act upon the telemetry data. IoT data from multiple locations are analyzed centrally with a complete view of all deployed devices. Storing the incoming data stream in various big-data repositories for long-term storage and analysis

**Q3. Discuss the application area of MQTT**

The Message Queuing Telemetry Transport (MQTT) protocol runs over TCP/IP and was designed for embedded hardware devices with limited embedded components and low power requirements. This protocol uses a publish-subscribe approach, which is inactive between transmissions and data retrievals. MQTT requires an intelligent IoT gateway.

MQTT was introduced by IBM in 1999 and standardized by OASIS in 2013. It is designed to provide conductivity between applications and mid-ware on one side and network and communication on another side.

**Applications**

* **Facebook Messenger –** Uses MQTT for online chats.
* **Amazon Web Services-** Uses Amazon IoT with MQTT
* **Microsoft Azure-** IoT hub uses MQTT as the main protocol for telemetry messages.
* **EVRYTHNG IoT Platform –** Uses MQTT as an M2M protocol
* **Adafruit –** Launches IoT cloud service for IoT experimeters called Adafruit IO.

**Q4 Explain CoAP in detail.**

* Constrained Application Protocol (CoAP) was designed to run on devices constrained by low power and lossy networks.
* It is based on a request-response model between endpoints.
* Client-Server interaction is asynchronous over a datagram-oriented transport protocol such as UDP.
* It is easily translatable to HTTP.
* CoAP can be routed over IP networks and supports IP multicast for M2M communications(like smart energy) between other IoT devices.
* CoAP is designed to interoperate with HTTP and the RESTful web at large through simple proxies.
* Because CoAP is datagram based, it may be used on top of SMS and other packet based communications protocols.
* CoAP packets are much smaller than HTTP TCP flows. Bitfields and mappings from strings to integers are used extensively to save space. Packets are simple to generate and can be parsed in place without consuming extra RAM in constrained devices.

**Messaging Modes**

* + - 1. Confirmable- Reliable transmissions
      2. Non Confirmable- Unreliable transmissions
      3. Piggyback- Client server direct communication
      4. Separate- Server response comes in a message separate from response.

**Features**

Reduces overheads and parsing complexity.

URL and content type support.

Support for discovery of resources.

Simple subscription for a resource and resulting push notifications.

Simple catching based on maximum messaging age.