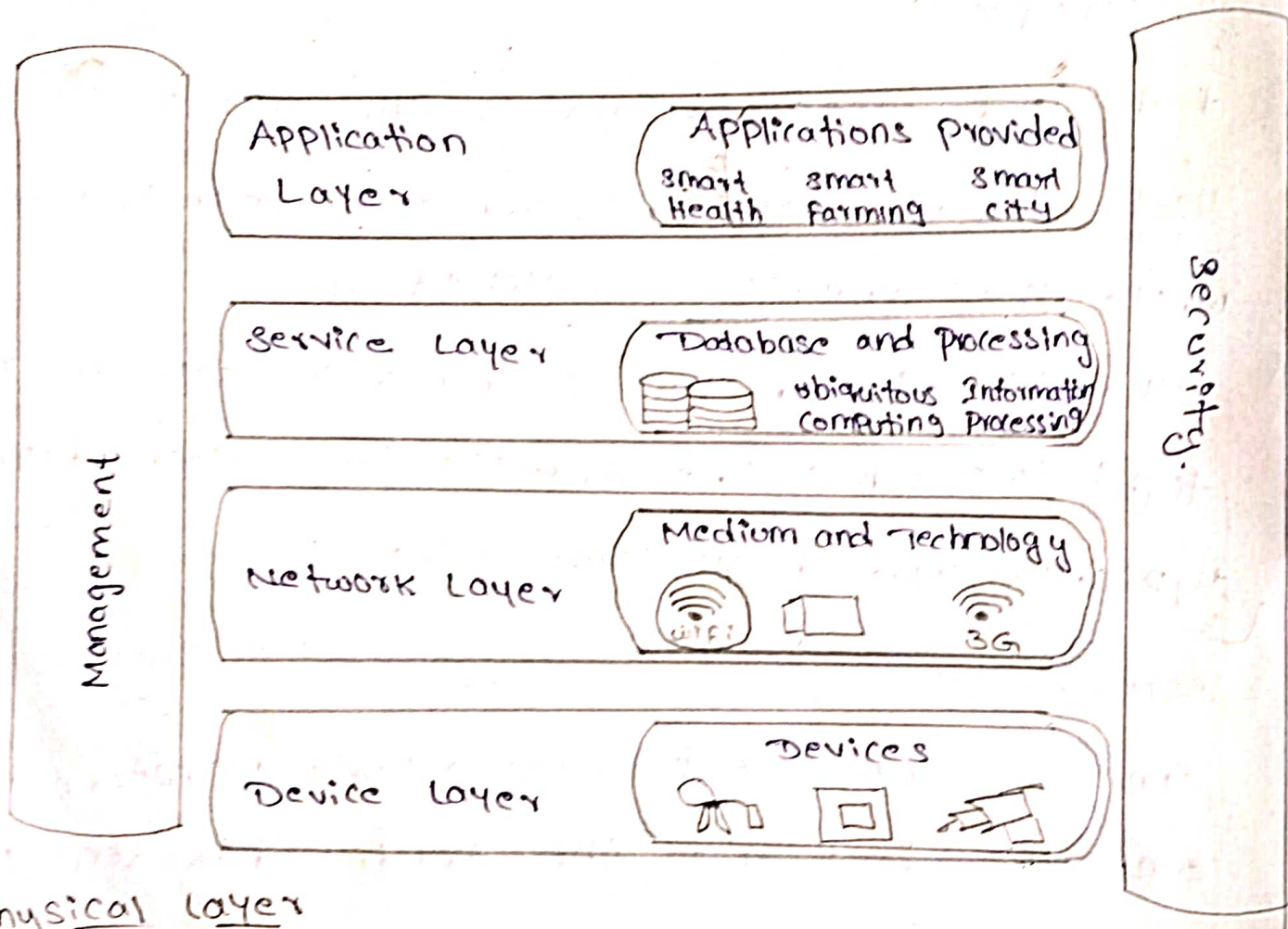b) Explain the IoT Reference model.

Just like the OSI reference model for the internet, IoT architecture is defined through six layers: Four horizontal layers and two vertical layers. The two vertical layers are management and security and they're spread over all four horizontal layers, as seen in the following diagram.

Physical layer

The physical layer is responsible for the following activities:

- Activating, maintaining and deactivating the physical connection.
- Defining voltages and data rates needed for transmission.
- Converting digital bits into electrical signal.
- Deciding wheather the connection is simplex, half duplex or full duplex.

Data link layer

The data link layer performs the following functions:

- performs synchronisation and Error control for the information which is to be transmitted over the physical link.

Network layer

following are the functions of network layer:
- To route the signals through various channel to the other End.
- The act as the network controller by deciding which route data should take.

Transport layer:-

The Transport layer performs the following functions
- It decides if the data transmission should take place on parallel path or single path.
- It performs multiplexing, splitting on the data.

Session layer:-

The session layer performs the following functions

* manages the messages and synchronizes conversation between two different applications.
* It controls logging on and off, user identification, billing and session management.

Presentation layer:-

The presentation layer performs the following functions:

* this layer makes it sure that the information is delivered is used a form that the receiving system will understand and used it.

Application layer:-

The application layer performs the following functions.

* It provides different services such as manipulation of information in several ways, distributing the result etc...

(b) what are the basic operations of COAP protocol.

constrained application protocol (COAP) is a specialised web transfer protocol for use with constrained nodes and constrained network in the internet of things.

#Most generally used for machine-to-machine (m₂m) applications such as smart energy and

building automation.

How does COAP function?

* COAP functions as a sort a HTTP for restricted devices, enabling equipment, such as sensors or actuators to communicate on the IOT. These sensors and actuators are controlled and contribute by passing along their data as part of a system.

* COAP uses UDP as the underlying network protocol. COAP is basically a client-server IOT protocol where the client makes a request and the server sends back a response as it happens in HTTP.

COAP security:-

* one must take security into account when dealing with IOT potocols. for Examples, COAP uses UDP to transport information. COAP relies on UDP security features to protect information.

* the smallest COAP message is 4 bytes in length, if omitting token, options and payload. COAP makes use of two message types, requests and responses, using a simple, binary, base header format.
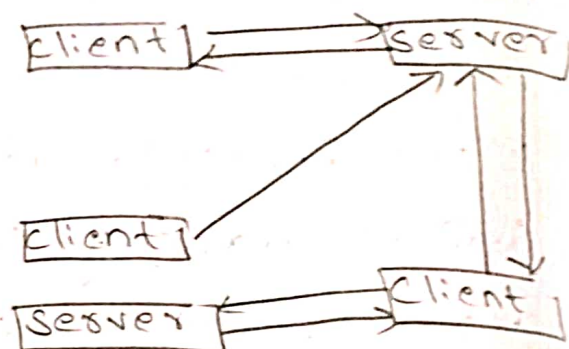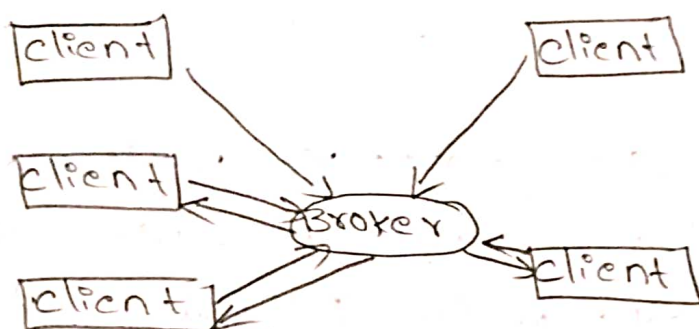
2. Explain the device discovery capabilities like register a device, Deregister a device with IOT

Device discovery capabilities :-

unlike It assets that are generally multi-purpose hardware, IOT devices core purpose-built systems. These devices are designed to perform a few task on a very repetitive basis. and the IOT security solution provides deep visibility into normal and suspicious.

Register a device in IOT :-

* create and register an IOT device from IOT Hu

First, let's look at how to register a new device from Azure IOT Hub. Goto Azure IOT Hub and select an environment.

* The IOT register is a tool that enables standard registration of data sources from the sensory network of different customers and

different suppliers, in one map".

* In your IoT Hub navigation menu, open devices, then select Add Device to add a device in your IoT hub.

* AWS IoT Bes provides a registry that helps you manage things. A things is a representation of a specific device or logical entity.

* strong IoT devic authentication can only be ensure through robust device identity provisioning protocols and data exchanges secred by public key infrastructure.

Deregister a device :-

Devices usually deregister from device management sevices for one of two reasons:

* The registration session lifetime on the Lwm2m server expires. Izuma device management deregisters Izuma device management client

* Device management client requests deregistration state calling the Mbed cloud client :: closec) API:

• Mbed cloudclient :: closec);

The result of that request can be:

• success

If device management client is successfully

deregistered from the device management service your application the on-status callback.

* Failure.

If the deregistration operation fails, the application receives the result through the error callback when device management client is deregistered from the Lwm2m server. For any reason, it's marked as deregistered in the device management services.

* If device management client tries to connect to the services while in the deregistered state, it's forced to perform a full registration again.

30a) Explain the following GPs

a) GPs.
b) Internet of Drones.

* A global positioning system (GPs) is a network of satellites and receiving devices used to determine the location of something on earth.

* GPs devices receives the radio signals, nothing their exact time of arrival (GPS), and uses these to calculate its distance from each satellite in view.

* Perhaps the most common use for GPs is in navigation systems. Combined with map

technology, It becomes a powerful tool for road vehicles and boats. GPS can pinpoint a device's location with accuracy and by comparing coordinates the statistics, the statistics can be used to calculate a device's direction of movement and speed.

features of GPS :-

* Real-time tracking. Track the location of your objects (vehicles, people, phones, bikes, etc). ~~

* Notifications Get instant alerts about your tracking object. ~~

* History and Reports. Download and review reports different formats: XLS, PDF, CSV, TXT ~~

* fuel savings

* Geofencing.

* POI & tools

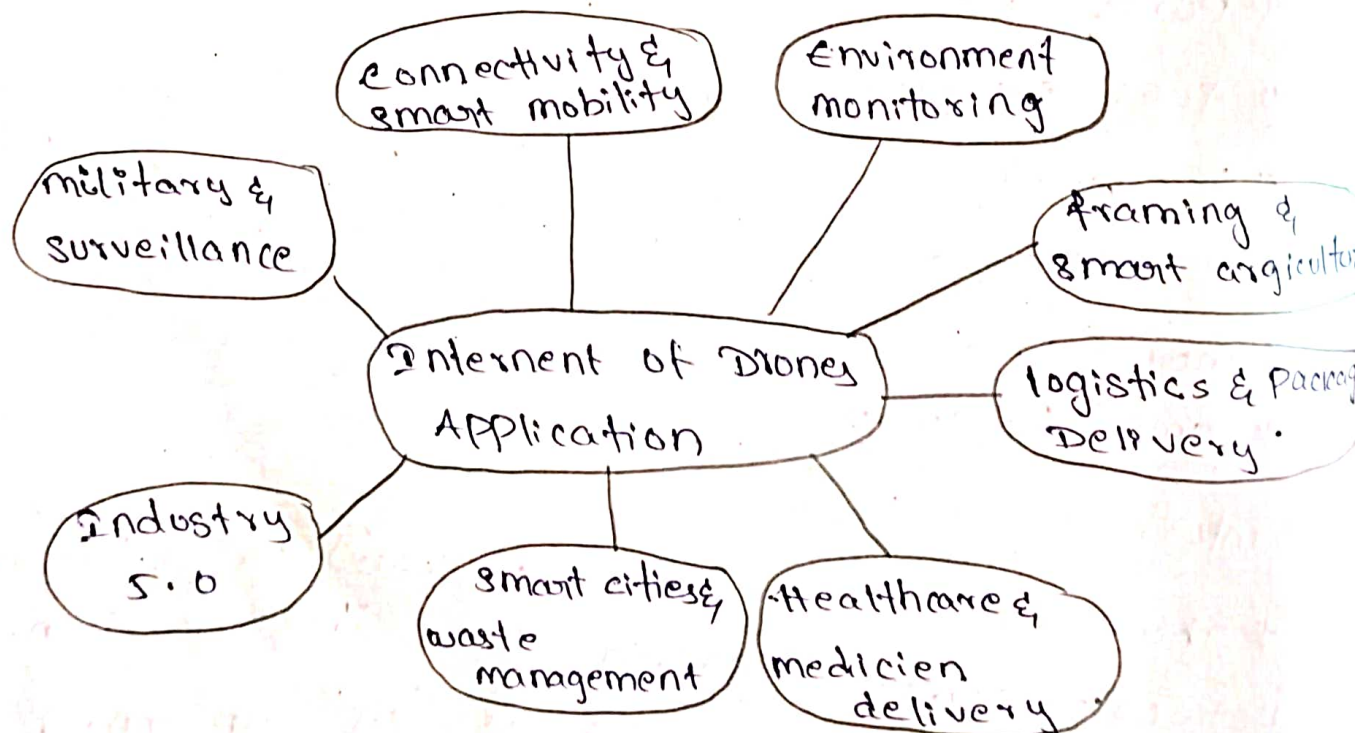* mobile,

* sms Gateway.

3b) Internet of Drones:

* The internet of Drones (IOD) is a layered network control architecture designed mainly for coordinating the access of unmanned aerial

vehicles to. controlled airspace, and providing navigation services. between locations referred to as nodes.

* Drones can also be used as remote inspection devices to help maintain IoT endpoint and other components. for example, a drone can check on the physical condition of tower-based sensor or other IoT - connected gear, thus eliminating the need for potentially dangerous in-person inspections.

* sectors like videography, search and resue, agriculture and transportation have adopted drone technology.

connectivity & smart mobility

Environment monitoring

military & surveillance

framing & smart agriculture

Internet of Drones Application

logistics & Packaging Delivery.

Industry 5.0

smart cities & waste management

Healthcare & medicien delivery.

4a) Discuss key features and aspects of Ardupilot

Ardpilot:-

Ardupilot is a trusted, versatile and open source autopilot system supporting many vehicle type, multi-copters, traditional helicopters, fixed wing aircraft, boats, submarines, rovers and more.

Ardupilot is an open source, unmanned vehicle Autopilot software suite, capable of controlling autonmous multirotor drones.

The main flight code for Ardupilot is written in C++ support tools are written in a variety of languages most commonly in python.

Features of Ardupilot?

* Introducing plone flight features. Automatic taxeoff Automatic landing Inverted flight.

* Ground control Stations.

* peripheral Hardware

* Additional information

* Ardupilot 4.1.10 support in-flight transition between GPs and NON-GPs environments.

4b) write in detail about UAV

* most UAVs are rechargeable and can store more energy than an IoT device.

* most IoT devices are very small and have a low battery capacity. Thus, UAVs can transfer energy to IoT devices via wireless power transfer (WPT) technology, which can increase the network lifetime

* unmanned aerial vehicles (UAVs) have enrmonos potential in enabling new applications in various areas, ranging from military, security, medicine, and surveillance to traffic-monitoring applications.

* An unmanned aerial vehicle (UAV) is an aircraft that carries no human pilot or passengers. UAVs, sometimes called drones, can be fully or partially autonomous but are more often controlled remotely by a human pilot.

* UAVs, subsequently they are dependent on sensors, antennas, and embedded a two-way communication to applications associated to remote control and monitoring

* The usefulness of robot aircraft for reconnaissance had been demonstrated in vietnam. At the same time early steps were being taken to use them in active

combat at sea and on land, but battlefield unmanned
aerial vehicles (UAV) would not come into their
own until the 4 1980s.
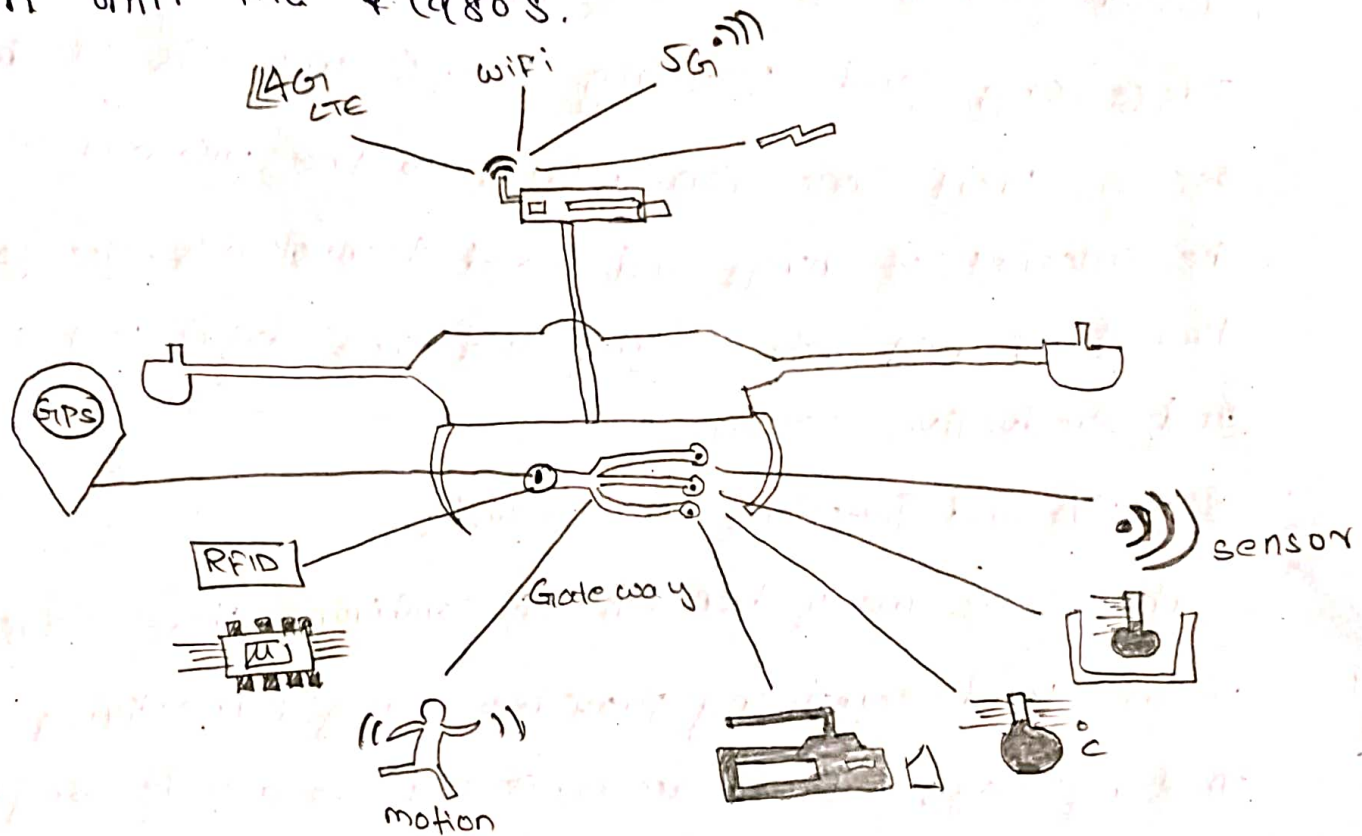
5. Explain IoT cloud-based services with an example?

cloud services in IoT:-

one component that improves the success of the
Internet of things is cloud computing. cloud computing
enables users to perform computing tasks using services
provided over the Internet. The use of the Internet
of things in conjunction with cloud technologies
has become a kind of catalyst. The Internet of
things and cloud computing are now related to

each other. These are true technologies. of the future that will bring many benefits. Due to the rapid growth of technology, The problem of storing, processing, and accessing large amounts of data has arisen. Great innovation relates to the mutual use of the internet of things and cloud technologies. The goal is to transform data into insights and thus drive cost-effective and productive action.

Benefits and functions of IOT cloud:-

There are many benefits of combining these services.

1. IOT cloud computing provides many connectivity options implying large network access. People use a wide range of devices to gain access to cloud computing resources. mobile devices, tablets, laptops.

2. Developers can use IOT cloud computing on-demand. In other words, it is a web service accessed without special permission or any help.

3. Based on the request, users can scale the service according to their needs.

4. cloud computing implies the pooling of resources. It influences increased collaboration and builds close connection between users.

5. As the number of IoT devices and automation in use grows security concerns emerge cloud solutions provide companies with reliable authentication and encryption protocols.

6. Finally, IoT cloud computing is convenient because you get exactly as much from the service as you pay.