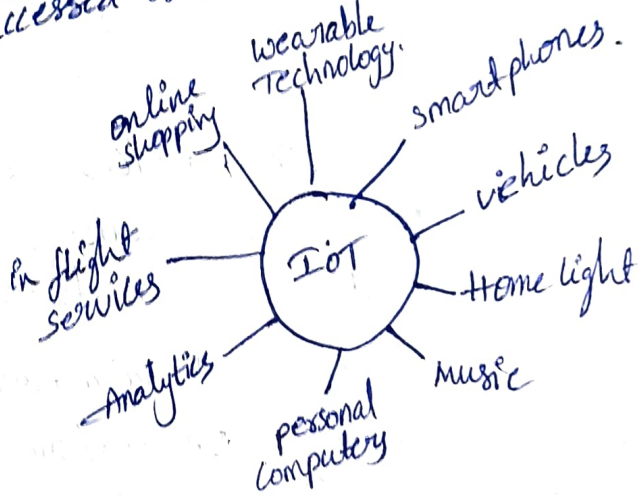
Introduction to IoT: Introduction to IoT, Architectural overview, design principals and needed capabilities, Basics of networking, M2M and IoT technology fundamentals- Devices and gateways, Data management, Business process in IoT, Everything as a service (xaas), Role of cloud in IoT, security aspects in IoT.

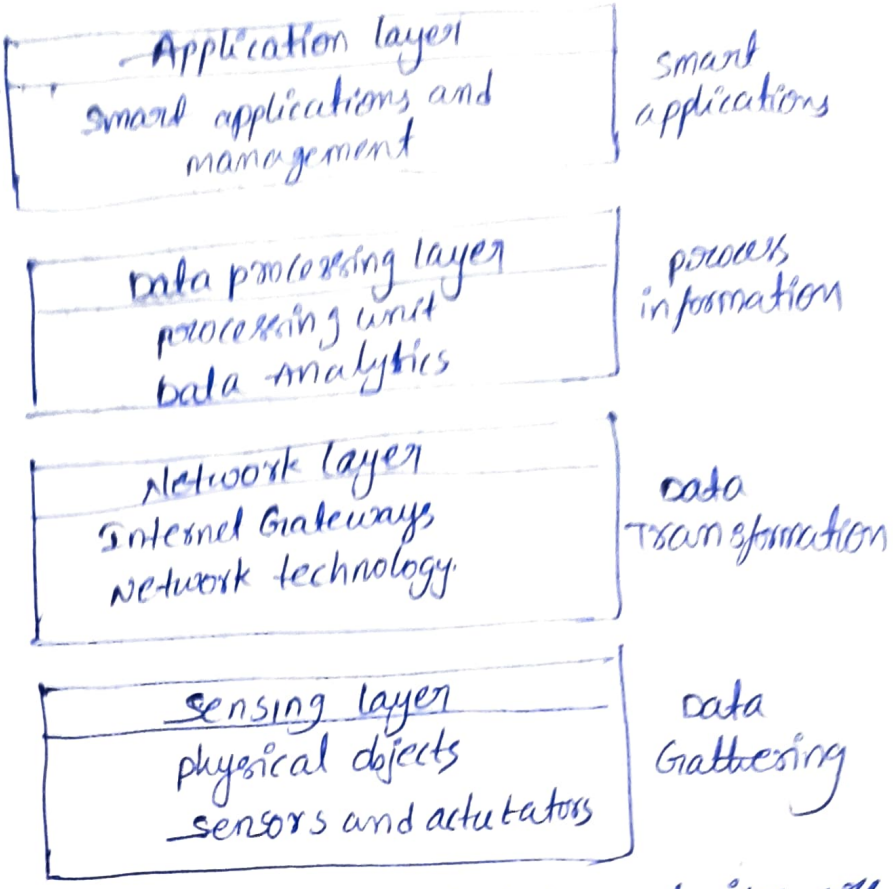
* **IOT:** IoT stands for Internet of Things; which means accessing and controlling daily usable equipment and devices using internet.

- The term "Things" in the internet of Things refers to anything and every thing in day to day life which is accessed or connected through the internet.



* **Architectural overview:-**

- IoT technology has a wide variety of applications and use of internet of Things is growing faster.
- The architecture of IoT depends upon its functionality and implementation in different sectors.
- the architectural overview mainly consists of 4 layers, 1. sensing layer, 2. Network layer, 3. Data processing layer and 4. Application layer.



1. Sensing Layer :- sensors, actuators, devices are present in this sensing layer. These sensors accepts data, processes data and emits data over network.

2. Network Layer :- network gateways and data acquisition system (DAS) are present in this layer. DAS performs the data aggregations and conversion functions.

3. Data processing layer :- This is processing unit of IoT ecosystem. Here data is analyzed and pre-processed before sending it to data center from where data is accessed by software applications often termed as business applications.

4. Application Layer :- This is last layer of 4 stages of IOT architecture. Data centers or cloud is management stage of data where data is managed and it used by end-user applications like agriculture, health care, aerospace, farming, defence etc..

smart applications

process information

data Transformation

data Gathering

, devices are
ese sensors accepts
a over network.

nd data Acquisition
DAS performs the
unctions.

ocessing unit of IOT
pre-processed
where data is
en termed as

n of 4 stages of
s management
used by
ure,

Design principles:- (9).

1. focus on value:-
   - In the world of IOT, user research and service design are more crucial then ever.
   - while early adopters are eager to try out new technology, many other are reluctant to take new technology into use and cautious about using it, due to not feeling confident with it.
   - whenever the peoples are adopted your IOT solutions, it must be more useful to the users or adopters.
   - In case, whenever a problem is arises then you have to solve it the problem. That is the real end user value of the solution.

2. Take a holistic view:-
   - The IOT solutions typically consists of multiple devices with different capabilities and both physical and digital touch points.
   - whenever design a IOT solution you take a holistic look across the whole system, the role of each device and service, and the conceptual model of how user understands and perceives the system.

3. put safety first:- (trust & security)
   - whenever you build a IOT solution and put into the real world you should be face consequence when something goes wrong.
   - At the same time the user of IOT solution is change
   - whenever you build a solution trusting is more imp, Trust built slowly and lost easily.

- whenever you build a new IoT solution, first practise it, if any errors are occur then feel free to say the errors to the users.
- And the last one is security or privacy. when you build a IoT solution it must be contain security. which means Third party can't access the data.

4. consider the context :- (signal lights).
   - IoT solutions exist at the crossroads of the physical and digital worlds.
   - commands given through digital interfaces may produce real world effects, but unlike digital commands, the actions happening in the real-world cannot necessarily be undone.
   - In the real world context lots of unexpected things can happen and at the same time user should be able to feel safe and contool.

5. Build a strong brand :- (brand).
   - TRUST

6. prototype early and often :- (Hw & sw)
   - The Hw & sw do not have the same life spans.
   - whenever you loss a Hw or sw it is difficult to upgrade due to security purpose.
   - so, whenever start design the IoT solution then the prototype and rapid iteration of both of Hw and the whole solution are essential in the early stages of the poroject

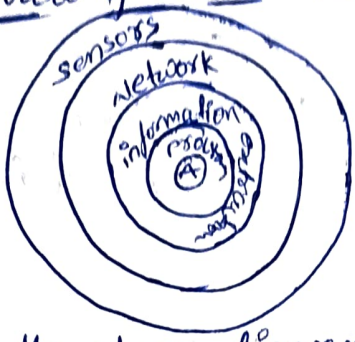
7. use data responsibly :-

M2M (Machine to Machine).

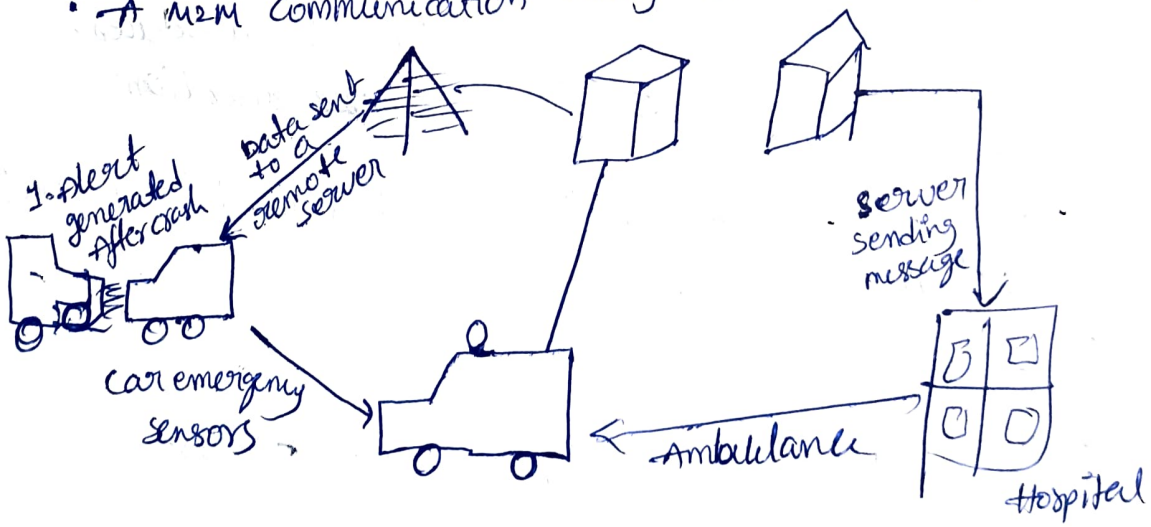
- M2M communication is one of the imp basic building blocks of an IoT.
- If two machines are interacted without human interference. that type of communication is known as M2M communication

For example: (robot and bridge)

- An overview of M2M communication can be represented as:



- In the above diagram the sensors collect the data from the remote areas and the collected data can be transform by using the network connection.
- The information can be extracted from the data that is transformed through the n/w connection.
- After extracting the information. This information can be processed to the relevant users
- Activate the processing data
- A M2M communication using sensors can be represnted



* IOT fundamental - Devices & gateways :-

IOT Devices :-

1) sensors
2) Actuators
3) Controllers.

1) sensors :- A better term for a sensor is a transducer.

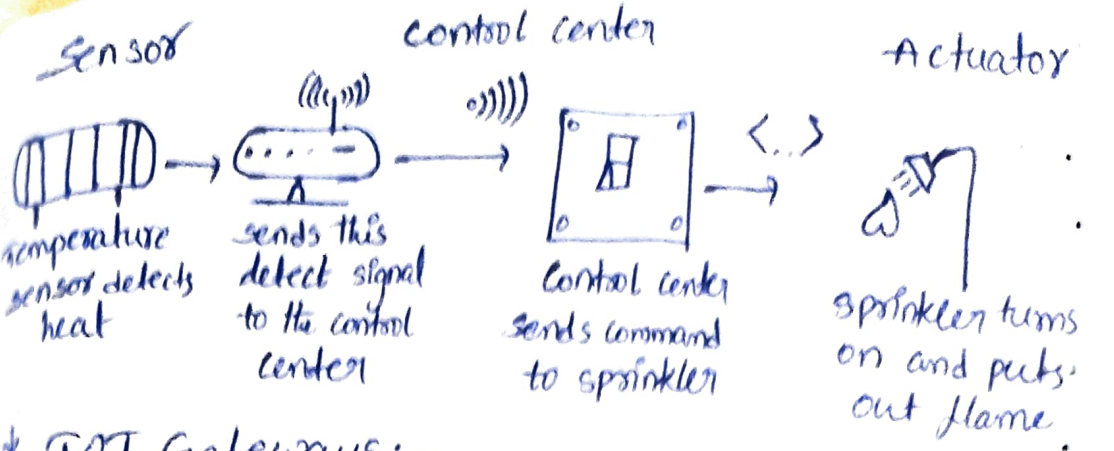
- A transducer is any physical device that converts one form of energy into another.
- In case of sensors, the transducer converts the some physical phenomenon into an electrical impulse.
- Types of sensors :-
  1) Temperature sensors (measure the amount of heat energy in a warm)
  2) Humidity sensor (The amount of water vapour in the atmosphere of air or other gases)
  3) pressure sensor (A pressure sensor senses changes in gases and liquids)
  4) level sensor (level sensor are used to detect the level of substances including liquids, powders and granular materials)
  5) Infrared sensor (The type of sensors sense characteristics in their surroundings by either emitting or detecting infrared radiation).

2) Actuators :- it is an another type of transducer.

- The actuators operates in the reverse direction of a sensors.
- It takes an electrical input and turns it into physical action.

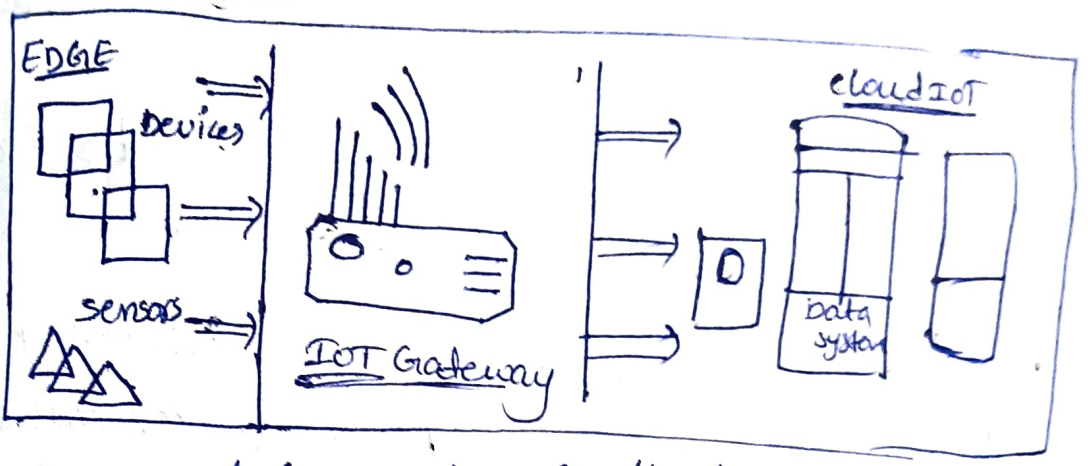
3) controllers :-

- It controlls the sensors and actuators.



* IOT Gateways :-

- Gateway provides bridge between different communication technologies which means we can say that a Gateway acts as a medium to open up connection between Cloud and controller.



- As IOT devices works with the low power consumption
- so they communicate with Gateway first using short range wireless transmission modes / network like zigbee, Bluetooth, etc.

Working of IOT Gateway :-

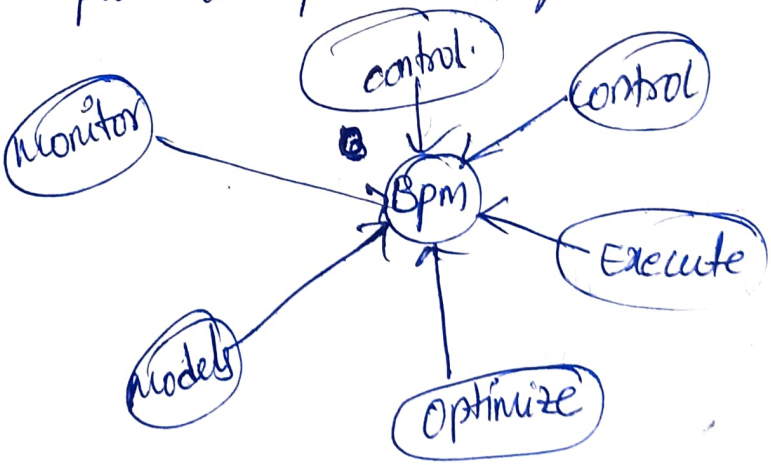
1. Receives data from sensor network.
2. performs pre processing, filtering and cleaning on unfiltered data.
3. Transport into standard protocols for communication
4. sends data to Cloud.

Key functionalities of IOT Gateways:-

- Establishing communication bridge
- provides additional security
- performs data aggregation
- pre processing and filtering of data.
- provides local storage as a cache/ buffer
- Data computing at edge level.
- Ability to manage entire device.

* Business process management (BPM):-

- Bpm updates the processes in real-time.
- It is set of activities that helps the business to run smoothly.:
- These processes begin from company's activities from the starting stage to the final stage. sales.
- The key process involved in Bpm is Risk management, business process modeling, business process outsourcing employ motivation and product inventory.
- The main objective is to improve the effitiveness and efficiency of a company's business and to improve the operational performances.



Advantages :-

- Guides users through decisions
- Real time visibility and process control
- Automate key decisions.
- Improve forecasting → ಅಂದಾಜು ಮಾಡುವುದು
- Improve productivity
- Lower cost.

Disadvantage :-

- Does not allow processes to be repeated
- It has its limit
- Lack of communication.

* Every thing as a service (Xaas) :-

- Everything as a service (Xaas) means anything can now be a service with the help of cloud computing and remote accessing.
- Where cloud computing technologies provide different kinds of services over the web networks.
- In Everything as a service, various tools and technologies and services are provided to user as a service.
- Before Xaas and cloud services, companies have to buy licensed products and install them, had to all securities on their site and provide infrastructure for business purposes.
- There are many varieties of cloud computing models like
  1. Software as a service (Saas)
  2. platform as a service (Paas)
  3. Disaster Recovery as a service (DRaaS).

4. infrastructure as a service (Iaas).
5. Communication as a service (Caas).
6. Network as a service (Naas).
7. Desktop as a service (Daas) etc..

* Examples of Everything as a service model:-

1. Hardware as a service (Haas):-
   - Managed service providers (MSP) provide and install some hardware on the customer's site on demand.
   - The customers uses the hardware according to service level aggrements.
   - This model is very similar to Iaas.
2. Communication as a service (Caas):-
   - This model comprises solution for different communication like IM (instant message), VOIP (voice over internet protocol) (wife calls instead of regular calls) and video conferencing applications which are hosted in the provider's cloud.
   - This method is cost-effective and reduce time expenses.
3. Desktop as a service (Daas):-
   - Daas provider mainly manages [storing, security, and backing up user data for desktop apps]
   - And a client can also work on pc's using third party servers.
4. Security as a service (SECaas):-
   - In this method, the provider integrates security services with the company's infrastructure through

the internet which includes anti-virus software, authentication, encryption, etc...

5. Health care as a service (Haas):-
   - IOT and other technologies have enhanced medical services like online consultations, health monitoring 24/7, medical service at the door step.
   - Eg:- lab sample collection from home, etc.

6. Transport as a service (Taas):-
   - Eg:- Uber taxi services is planning to test flying taxis and self-driving plans in the future.

* The role of cloud computing in IOT :-
   - Cloud computing works to improve the efficiency of daily tasks in conjuction with the IOT.
   - The cloud computing is about providing a path for data to reach its destination while the IOT generates a huge amount of data
   - According to Amazon web services, There are four benefits of cloud computing:

1. No Need to pre-guess infrastructure capacity needs.
2. saves money, because you only need to pay for those resources that you use, the larger the scale, the more savings.
3. In a few minutes, platforms can be deployed around the world
4. Flexibility and speed in providing resources to developers.