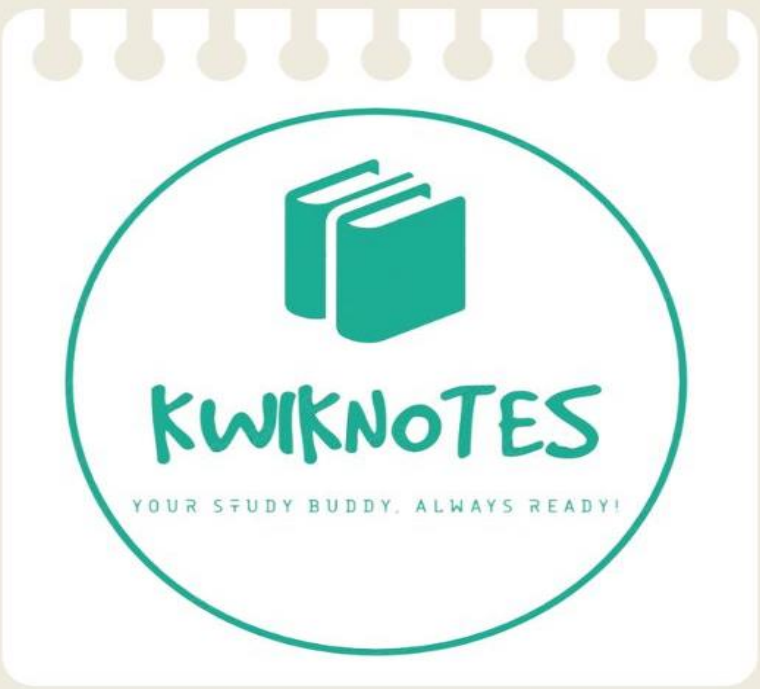

HANDWRITTEN NOTES

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IOT

Introduction

It refers to interconnectedness of physical devices such as appliances & vehicles that are embedded with software or sensor which enable these objects to connect, communicate & exchange data.

Simply, it means every object that are connected to internet can communicate

It is networking of physical devices with embedded softwares.

Over a billion IOT devices are currently working on IOT, 20 billion to reach in future

Applications

1) Smart Home Automation: IOT helps to control & monitor house appliances, security camera, lights, locks, etc.
   Ex- Amazon Echo.
2) Healthcare: In this, IOT can monitor them, help doctor access data
3) Smart Cities: Used to manage traffic lights, environment monitoring, etc.
4) Industrial IOT: IOT sensor to monitor equipment, work machine together
5) Agriculture: Monitor soil condition, crop health

c) Safety & security → real time camera.

COMPONENTS.

1) Low power embeded system →
Tiny comp who use less battery power. They are made to last longer on single battery charge.

2) Sensors
Sensor are devices that can sense or perceive environment. They can detect human, see image, measure temp.

3) Control Unit : Brain of IoT that making decisions. Handle tasks like processing & making decision

4) Cloud Computing : Data collected is in huge quantity & must be stored in a reliable location

5) Big Data : This data is used to learn & discover thing by IoT devices

6) N/W connection : to talk to internet devices establish a connection. They can send receive msgs.

IoT is interconnection of devices with controlized systems.
Enhance efficency, convinience, automation
Ex- thermostate, fridge, , car,
toothbrush are equiped with sensors
processor & internet connectivity.
IOT can enable to take fridge take inside pics & suggest dishes acc to material available

locks oprated by mobiles
& lights adjust to warm or cool.

Characteristics
- Unique Identity
- Dynamic nature
- Self - adapting
- Hetroginity
- Internet connect
- Self configuring
- Connectivity

History

In 1999, tech expert named Kevin Ashton coined IOT.
He used special tags to track & manage physical stuff like stores.

In 1000, IOT was used for tracking products in

It came to life of normal people in 2010, thermostat, smart watch. & industries.

RFID Radio-frequency Identification allowed to be identified / tracked remotely

Architecture

IOT has a wide variety of applications & use of IOT is growing.

There is no standerd architecture which should be followed by all IOT app strictly

Architecture depens on functionality & Implementation of app in diff sectors.

Still a basic process that is followed is 4 stage architecture of IOT

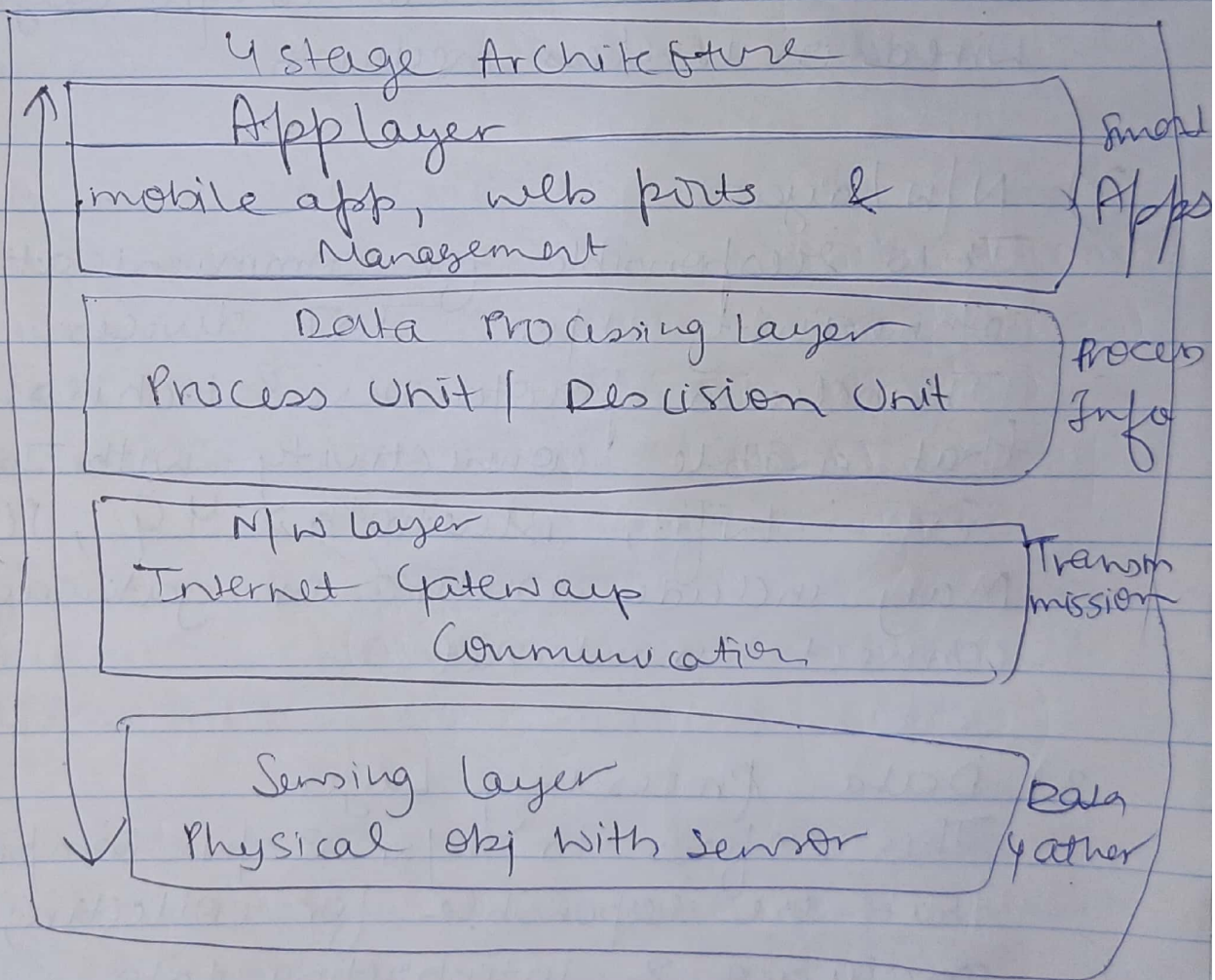
1) Sensing Layer
It is the first layer & is responsible to collect data from diff sources.
This layer include sensor & actuator that are placed in env to gather info about temp, humidity, Sound, people, etc.

Devices are connected to n/w layer through wired or wireless medium.

2) N/W Layer
It is responsible for communication & connectivity b/w IoT devices.
It includes protocols & technologies that enable connectivity with Internet
Ex - Wifi, Bluetooth, 4G, 5G, etc.
May include routers or gateways to connect to internet.

3) Data Processing Layer
This refers to h/w & s/w components that are responsible for collecting, analyzing & interpreting data
Responsible to receive raw data, process & make it available for future.
Includes data management tools, analyzation, visualization.

4) Application Layer
Topmost Layer that interacts with enduser and provide user friendly interfaces / functionalities that enables users to access & control IoT devices.
This layer include mobile app, web portals, etc.



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Standardizing IoT

It is like creating a set of rules that everyone agrees to follow when making & using IoT devices

Use of standards

→ Ensure interoperable & cost effect solution
→ Open opportunity in new area
→ to reach full potential
→ Reduce Security Risk.

1) Interoperability → iot device developed by different manufacturers should work together through common protocols

2) Security → Security protocols against security breaches

3) Data Format & Models
Standerse data format ensure that data generated by IoT can be understood & processed by others.

4) Comm protocol : to communicate using diff protocol such as HTTP, ensuring data is transfered reliably.

5) Wireless Connectivity (Bluetooth)
6) Scalability (handle growth)

M2M

Machine to Machine refers to comm & interactions b/w devices / machines in context of IOT.
In this devices or sensors are connected to each other without human intervention. This communication enable IOT to gather, process & transmit data to make decision.

- Data Transmission
- Automated Interaction (without human)
- Diverse (used in wid Range of areas)
- Protocols (IOT relies on MQTT, HTTP).
- Security (Security of M2M is imp to protect data through encryption, passwords, authentication)
- Scalability (M2M system to be scalable to accomate growing no. of devices)

IOT
→ Intelligence to make decisions
→ connection is N/W oriented
→ Protocols - FTP, HTTP

M2M
Some degree of intelligence
Point to Point Connection
Traditional Protocols.

→ Internet always req
→ Involves both h/w & s/w
→ Larger scope
→ Support API Integration
→ Horizontal Approach

→ May / Maynot
→ Mainly s/w
→ limited scope
→ No support
→ vertical Approach

Data Management

This in IOT is a critical step of ensuring that a vast amount of data generated by IOT devices is collected, processed, stored & analyzed
Effective data Management is essential deriving meaningful insights, take informed decisions, maximize IOT deployments.

1) Data Collection
2) Data Ingestion : Stored at Centralized place for processing
3) Data Storage : Securely at a place
4) Processing : to get insights
5) Integration : with other source
6) Security : through Encryption.

BPM

Business Process Management

It refers to the use of BPM technique & tools to streamline & optimize operation of org by integrating IoT data & devices.

It can provide realtime data & insights to improve business processes

Ex - IOT sensor can monitor machinery help in attendence system.

Changes faced by Company

Data: As more & more data is recorded, it need to be processed & Analysed
Innovation: to deliver new benefits to customer
New way of buying: Online shopping
Centralized BPM

Integrating

IOT plays a significant Role in BPM by introducing new capabilities, data source & efficiencies

Key Roles are:

1) Process Automation : IOT can automate BPM. Ex- Manufacturing sensors to trigger maintainence Req.

2) Real time Monitoring : IOT provide real time data collected by sensors

3) Predictive Maintainence : Used to make predictions about failiure of H/W

4) Efficiency & cost Saving : as BPM can operate more efficiently saving money & energy

5) Data Gathring

6) Analysis to undrstand what's happening

7) Asset tracking : Location & Condition

8) New Business Model : Creation of new Business Model

XAAS

Collective term for Everything / Anything as a Service
Used in world of technology & business

Represent a shift from traditional ownership & Management of Resources to a more scalable & flexible model

It is on-demand service model that allows individuals & businesses to access a wide Range of Resources over internet

It allows take resources without investment & maintainence
Scale resources up & down

XaaS	Saas
→ Wide Range of Services including s/w, infra, platform & specialized Servics → Versatile & adaptable to needs and industries → AWS (Paas), Google Cloud (Iaas) Microsoft 365 (SaaS)	provide specialized s/w Services focused on s/w delivery Microsoft 365

Unit - 2

Embedded System

These are devices & objects / small scale computers that build unique computing system. These may/may not be connected to internet.
Also called RTOS (Real time OS)
Embedded System runs an single applicat
However, these device can connect to internet and communicate to other devices.
Ex - watch displaying time.
These are standalone devices designed to do a specific thing.

⇒ An IOT embedded system that are connected to internet can perform tasks & also communicate with other

- It is a combination of H/W & S/W
- The particular task has to be completed in given time.
- Limited no. of features
arrangement in which all its units assembled work together acc to set of Rule
- Powerful enough to control devices

mobiles have integrated OS like Android that start when phone is switched on.

used in various products from household appliances to industrial systems

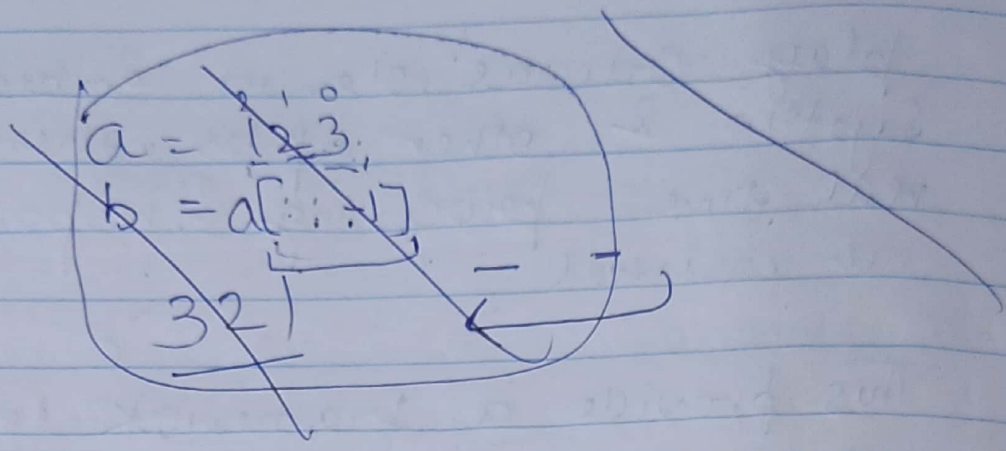
They are expected to be dependable, energy efficient & cost effective.

Applications

Control & Monitor, Collect Data, Comm with user
Ex - Calculate room temp & adjust.

Advantage.

1) Power Efficient: have low power consumption
2) Dedicated task: prform dedicated task with efficiency resulting in optimized performance
3) Compact size: Small so that they can be integrated in small devices also
4) Customization - acc to specific requirements & adapt to apps
5) Real time operations: Embedded system can respond to external events or input in real time
6) Enhanced control
7) I/O flexibility 8) Reliability



Disadvantages

1) Limited Flexibity - not versatile as general purpose comps. for a typical task only
2) Development complexity : development design can be complex or time consuming
3) Resource contraint : have limited Resources including power, storage
4) Cost of Customization - costly
5) Integration challenges : integrating new feature into already existing can be difficult.
6) Compatibility issues : with newer components.

Used in Multimedia players, airplane navigation system, medical equipment

RTOS

Real Time OS

Specialized software Component

play crucial role in embedded System & other apps where real time processing & responsiveness are essential

This provide a framework for managing execution of tasks & handelling systems resource, ensuring crucial tasks meet time requirements.

Design Constraints H/w S/w

These are limitations and requirements that desigers & engineers must consider when duveloping a product or system. whether its H/w or S/w.

H/w related Contraints:

1) Physical size & weight : Products like mobile, watches and other IoT duvice have strict size & weight limitation,
2) Power Consumption : must be less to extend battery life

Cost: affter component selection, manufacturing cost

4) Processing Power: Processing capabilities determine system performance

5) Thermal Management: should not heat

6) Interoperability: compatible with others

S/W Constraints

1) Performance: S/W must meet system performance including response time / speed
2) Memory usage: S/W must be memory efficient
3) Scalability: S/W must be designed to accomodate growth
4) UX - good user experience
5) Security: data security to be ensured
6) Reliability
7) Development Budget.

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