Internet of Things

Unit-I

The Internet of Things

* An Overview of IOT
* IOT Technology.
* Behind IOT's.
* Sources of the IOTs.
* M2M communication.
* Examples of IOTs.
* Design principles for Connected Devices.

* An Overview of IOT:-

The Internet of things (IOT) is a system of inter-related devices connected to a network and/or to one another, exchaning data without requiring human to machine interaction. In other words we can say that, IOT is a collection of electronic devices that can share information among themselves.

Examples include smart factories, smart home devices, medical monitoring devices, wearable fitness trackers, smart city infrastructures, and vehicular telematics. Potential issues for ~~congress~~ digital privacy & data security.

Eg:- Smart Homes:- Consumer IOT devices used in homes & buildings are often grouped under the "smart home" category, including smart appliances, smart TV's, smart entertainment systems, network connected light bulbs, outlets

door locks, door bells, & home security systems. Smart home IOT devices can be connected to a single network & controlled remotely over the internet via a central device (or) Computer.

→ Internet of things Technology:-

The term IOT, or Internet of things, refers to the collective network of connected devices & the technology that facilitates communication between devices and the cloud, as well as between the devices themselves.

In other words we can say that the Internet of things refers to the rapidly growing network of connected objects that are able to collect and exchange data in real time using embedded sensors. Thermostats, cars, light, refrigerators & more appliances can all be connected to the IOT.

The latest IOT Technology was Blockchain. Increased adoption of blockchain technology is one of the latest IOT Trends. Blockchain can ensure data protection in IOT devices.

There are a lot of new technologies in the Internet of things, the key technology of which is radio frequency identification technology (RFID), sensor technology, network communication technology & cloud computing.

Behind IOT's:-

The following entities provide diverse technology environment and are examples of technologies are involved in IOT.

* Hardware → ARM Embed, Intel Galileo
* Intigrated development environment (IDE) for developing device s/w, firmware & API's.
* Protocal → HTTP, MQTT, XMPP.
* Communication → Bluetooth, WIFI, 2G, 3G/4G, 5G.
* N/w Backbone → IPV_4, IPV_6, UDp.
* Machine learning algorithms & Software.

The following 5 entities can be considered for the slevels behind an IOT Systems:-

1. Device platform consisting of device h/w & Software using a microcontroller and s/w for the device applications & web applications.
2. Connected and network enabling (Circuit, connectivity, protocal) Internet network of physical objects is called things.
3. Server and webprogramming enabling webapplications and webservices.
4. Cloud platform, enabling storage, computing prototype and product development platforms.
5. Online transaction processing, online analytics processing, data analytics & Knowledge discovery enabling wider applications of an IOT systems.

→ Sources of the IOTs:-

There are three sources of IOT development

* Popular IOT development Boards
* Role of RFID & IOT Applications.
* Wireless sensors network.

↓ Popular IOT development Boards:-

Arduino UNO:-

- Which is uses micro controller AT mega 324 that supports arduino.
  1. Wi-fi
  2. Ethernet
  3. USB Port
- Micro SD Card slot & 3 Reset Buttons.
- The board also combines with other Ar9331 that are linux.

Micro arduino:-

* This is a small board compactible with arduino.

Intel galileo:-

* This is a line of arduino certified development board.
* Galileo is based on Intel x86 architecture.
* It is open source hardware that features the intel SOC x1000 Quark based SOC.

ad-hoc:-

Galileo is pin compatible with arduino. It has 20 digital I/O 12-bit pwm for more precise control

* Using other IOT devices, smart lighting devices can also be turned on and off by voice alone.
* The power consumption of these devices can also be easily monitored using IOT.

2, Smart locks:-

* IOT applications in home security have enabled users to do away with traditional locks and invest in smart locks.
* Smart locks do not require a physical key to open.
* Instead, you can authorise individual house members to open the doors through biometric information such as iris scans (or) finger prints.
* Face-mapping can also be utilised to open smart locks.

3, Microsoft Wrist band:-

* It can fit new tracking.
* It can help with productivity by discipline email, calendar, and message notifications.
* Works with windows phone, Ios devices and Android devices.
* Sensors:- Optical heart rate, skin temperature, capacitive sensor, galvonic skin response and Barometer etc.,

Along with these we are having smart home, wearable watches, smart cities, smart agricultures, Hospital management, Street lighting etc.,

→ Differences between IOT & M2M:-

M2M	IOT
1, M2M is about direct communi -cation between Machines	1, The IOT is about sensors Automa -on and Internet platform.
2, It supports point-to-point Communication	2, It supports cloud Communication.
3, Devices donot necessarily rely on an Internet connections.	3, Devices rely on an Internet Connections.
4, M2M is mostly hardware-based technology.	4, The IOT is both hardware & Software based technology.
5, Machines normally communicate with a single machine at a time.	5, Many users can access at one time over the Internet.
6, A device can be connected through mobile or other network.	6, Data delivery depends on the Internet protocal (IP) network.

→ Examples of IOT's:-

1, Smart lighting:-

* This is one of the IOT examples that have gradually been coming into common usage.
* Bulbs and baltens connected to wifi can be turned on and off remotely.
* Schedule for usage can be set for these devices along with their brightness controlled and their power consumption monitored.

6 analog i/p & Support power over ethernet.

Intel edison:-

* This is a compute module it enable creation of Prototype & fast development of prototyping projects & rapidly produces IOT & Wearable computing.

* It enables seamless device inter network and devices to cloud Communication.

* It includes foundation tools. i.e., store & process data in the cloud.

Beagle board:-

This is very low power requirements. It is a card like computer which can run arduino & linux.

Raspberry-pi Wireless Kit:-

Which is used enabled wi-fi connected devices.

* It includes document for 29 different projects (or) we can come up with your own.

* This is a free for devices but all of the included code is open sources.

2, Role of RFID & IOT:-

Applications:-

* Earlier IOT system were interconnected RFID Basic system.
* RFID enables tracking & inventory control identification in supply chain system.
* RFID have new applications in factoring device.
* The RFID is a Board Production.

3, Wireless Sensor Network:—

* Sensors can be network using wireless technolog Can Co-operatively monitor physical (or) Environmental conditions

* Sensors data get from the remote locations, which ma not be accesible.

* Each Wireless sensors has communication abilities for which it use a radio frequency transever.

* Each node either has an analog sensor with a signal conditional circuits (or) digital sensors.

Defination Wireless:— It is defined as a network in which each sensor node connects wirelessly and has capabilities of competitions for data compaction & agregation.

WSN Node:— A WSN node has limited computing power, It may change topology rapidly.

* The WSN and the topology changing environmental function as an adhoc network's.

→ M2M Communication:—

* Machine-to-machine (M2M) refers to networking of machines for the purpose of remote monitoring & control & data Exchange. Here, below figure shows the end-to-end architecture for M2M system Comprising of M2M area Network Communication network, and application domain.

* An M2M area network comprises of machines which have embedded hardware modules for sensing, actuation & Communication.

* Various communication protocals can be used for M2M local area network such as Bluetooth, Zigbee, ModBus, M-Bus, Wireless M-BUS Etc..,
* The Communication protocals provide connectivity between M2M nodes with in the M2M area network.
* The Communication network provides connectivity to remote M2M area network.
* The Communication network can use either Wired (or) Wireless network (IP-based)
* Here, non-IP based protocals are used within M2M area network the M2M nodes within one network cann't communicate with nodes in an external network.
* To enable the Communication between remote M2M area networks, M2M gateways are used.
* The Communication between the M2M node and the M2M gateway is based on the communication protocals which are native to the M2M area network.
* M2M gateway performs protocal translations to enable IP-connectivity for M2M area networks.
* M2M gateway acts as a proxy performing translations from/to native protocals to/from Internet protocal (IP).
* With an M2M gateway, each node in an M2M area network appears as a virtualized node for external M2M area networks.
* The M2M data is gathered into point solutions such as enterprise applications, service management applications or remote monitoring applications.
* M2M has various application domains such as smart metering, home automation, industrial automation, smart grids etc.,

* M2M solution designs (such as data collection and architectures and applications) are specific to the M2M domain.

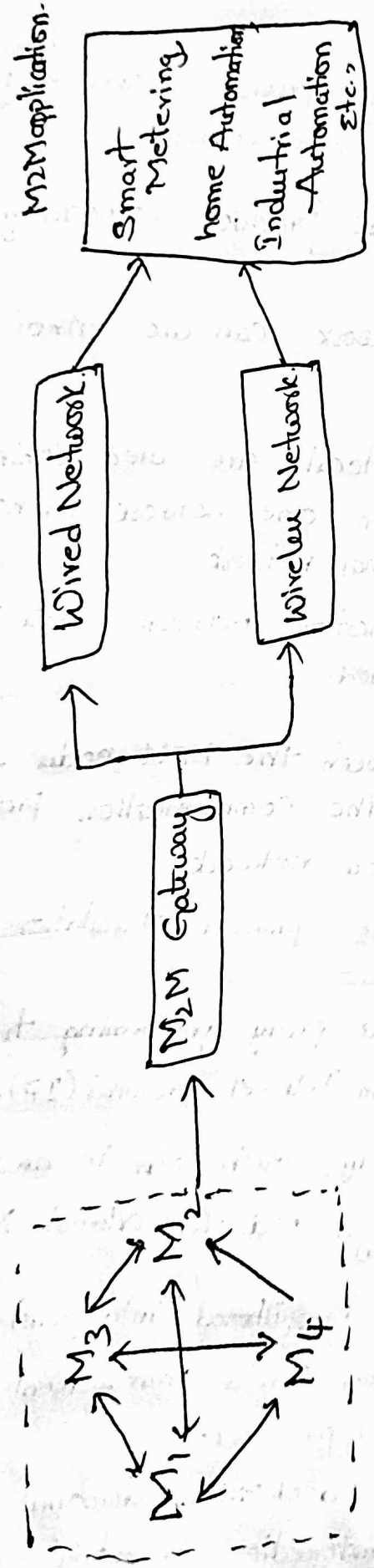

Fig- M2M system Architecture.

Design Principles for Connected Devices:-

Focus on Value:-

In the World of IOT, User research and service design are more crucial than ever. While early adopters are eager to try out new technology, many others are reluctant to take new technology into use and cautious about using it, due to not feeling confident about using it; due to not feeling confident with it.

For your IOT solution to become widely adopted, you need to dig deep into users' needs in order to find out where lies a problem truly worth solving and what is the real end user value of the solution.

2. Take a holistic View:-

IOT solutions typically Consist of multiple devices with different capabilities and both physical & digital touchpoints. The solution may also be provided in cooperation with multiple different service providers. It is not enough to design one of the touchpoints well, instead you need to take a holistic look across the whole system, the role of each device & service & the conceptual model of how user understand & perceives the system. The whole system needs to work seamlessly together in order to create a meaningful experience.

3. Put Safety first:-

As the IOT solutions are placed in the real word Context the consequences can be serious, when something goes wrong. At the same time the users of the IOT solutions may be vary of using new technology.

so, building trust should be one of your design driver. Trust is built slowly & lost easily, so you need to make sure that every interaction with the product / service builds the trust rather than breaks it.

In Practise, first of all it means understanding possible error situations related to context of use H/w, S/w and network as well as to user interactions & trying to prevent them.

Secondly, if the error situations still occur, it means appropriately informing the user about them and helping them to recover. Secondly, it means considering data security & privacy as key elements of your design.

It is really important for users to feel, that their private data is safe, their home, working environment, & everyday objects cannot be hacked and their loved ones are not put at risk. Thirdly, quality assurance is critical & it should not only focus on testing the S/w, but on testing the end to end system, in a real-word context.

4, Consider the Context:-

IOT solutions exist at the physical & digital worlds. Commands given through digital interfaces may produce real word 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 in control. The context places also other kind of requirements to the design.

Depending on the physical context, the global goal might be to minimize distraction of the user or to design devices that hold up against changing weather conditions. IOT solutions in homes, workplaces & public areas are typically multi-user systems & thus less personal than Eg:- screen based solutions used in smartphones, which is also brings into Picture the social context where the solution is used & its requirements for the design.

5, Build a strong brand:-

Due to the real world context of the IOT solutions, regardless of how carefully you design things & aim to build trust, something unexpected will happen at some point & your solution is somehow going to fail.

In this kind of situations, it is of utmost importance, that you have built a strong brand that truly resonate with the end users. When they feel connected to your brand they will, be more forgiving about the system failures & will still keep on using your solutions.

6, Prototype early & often:-

Typically HW & SW have quite different lifespans, but a succesful IOT solution needs both the HW & SW elements, The lifespan should be aligned. At the same time, IOT solutions are hard to upgrade, because connected object is placed somewhere, it is not so easy to replace it with a newer version, epecially if the user would need to pay for the upgrade & even the

Software within the connected object may be hard to update due to Security & privacy reasons.

Due to these factors & to avoid costly hardware iterations, its crucial to get the solutions right, from the beginning of implementation.

7, Use data responsibly:-

IOT solutions can easily generate tons of data. However, the idea is not to hoard so much data as possible, but instead to identify the data points that are needed to make the solution functional & useful. Still, the amount of data may be waste, so it's necessary for the designer to understand the possibilities of data science & how to make sense of the data.

Data science provides a lot of opportunities to reduce user friction. i.e., reducing use of time, energy & attention or diminishing stress. It can be used to automate repeated context dependent decision, to interpret intent from incomplete/inadequate input or to filter meaningful signals from noise.

Understanding what data is available & how it is can be used to help the user is a key element in designing Successful IOT services.