

# #) INTRODUCTION TO THE INTERNET OF THINGS AND EMBEDDED SYSTEMS

## Module - 1

### #) Objectives

- define the term "IoT".
- State the technological trends that have led to IoT.
- Describe the impact of IoT on society.

### → IoT

- Internet will modernise the technical staff, and it will improve the technology.
- Internet access gives access to external computation and data
- A remote antenna :- There are very important compared to the Barcode and, these contain the processor inside it.
- RFID :- Electronic version of the Barcode, contains Antenna within it.

### #) IoT Device vs. Computer

- Designed methodology are different.
- IoT devices are unique.
- IoT device have a main function separate from computation.
  - ↳ card drive, phones make calls, TVs display shows computation is a means to an end.
- Computers are general purpose
  - Ok on executing any thing.
  - Not particular for the particular code.

→ IoT devices are the special purpose

• software and hardware are efficient for other but inefficient for other tasks.

Ex:- Music player is good for the music but terrible for the video.

→ laptop can do both but less efficient.

### #) Trends in the Adoption of IoT

- convergence of several trends.
- cost of hardware has decreased
  - ENIAC 1945 : \$500000
  - Generic laptop computer today : \$500.

### #) Hardware size

→ Less weight and size needed to incorporate computation into devices.

• ENIAC 1945 : 1800 square feet  
Even the laptop nowadays are where small.

### #) Internet Access

→ Internet available almost everywhere in the developed world.  
→ But only some lack.

→ Data costs are fairly low  
→ But bandwidth is high

### → IoT Interfacing to the cloud

→ Siri enables search with verbal questions.

→ IoT is pervasive :- it's everywhere,

## Module-2

### #> Embedded System

- Define what an embedded system is in terms of its interface.
- \* Enumerate and describe the components of an embedded system
- \* Describe the interactions of ES with the physical world

→ what actually the Embedded.

→ we learnt about the IOT device and the process of embedding the device into the system is known or considered to be Embedded system.

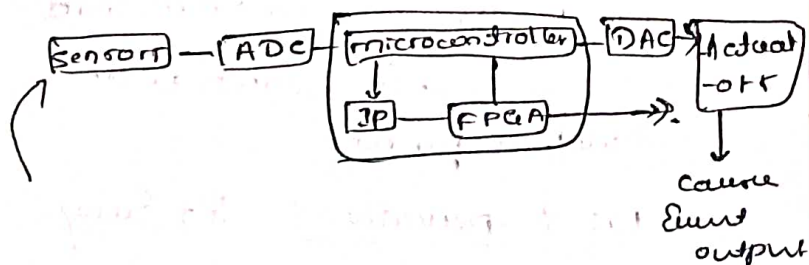
⇒ computer based systems that do not appear to be computers. Complexity is hidden inside from the user.

OK. now Embedded System is different from the IOT, because, IOT devices are connected to the Internet and Embedded systems are may or may not, they are mainly have computer complexity.

→ moore's law says that machines are getting eventually faster every year.

### #> MORE ON EMBEDDED SYSTEM

→ Software & Hardware make best combo.



Intellectual property (IP) core very useful for common tasks. like  
→ New controllers (Ethernet, CAN)  
→ Audio/Video (audio codec, D/A controller)

FPGA :- it is used for the flexibility, reconfigure the device, not faster.

### # COMPONENTS

#### ① Microcontroller

→ It is the main chip present on the board [Arduino], it will execute the program that we write.

→ it will read the input from the other components and it controls other components.

Microcontroller is basically smaller or weaker than the microprocessor. (heavy duty, more store, )

→ microcontroller (cheaper processor) lower end microprocessor.

### #> Analogy to Digital conversion

⇒ convert analog data to digital data.

→ To understand this lets understand digital & Analog [0, & 1] & real & integer numbers. In the real number only (0, & 1) & in integer it's infinite number (0, 0.1, 0.2, 0.5, 0.99, 1)



Analog:- In the sense, we can alter accordingly, but ex:- dimmer switch to adjust the light, Sound volume,  
 → Human beings almost are digital.  
 → Digital :- on or off (real numbers) like switch button either on or off. (B/w that analog will be converted to digital)

### Module-3

Hardware & Software Components

Components & tools of Embedded sys.

- ① Identifying core Hardware components most commonly used in IoT devices.
- describe the interaction b/w Hardware & software in IoT devices
- describe the role of an OS to support in IoT device
- Data sheets Give details of each hardware component.

Microcontroller characteristics

- ↳ Data path Bitwidth (32 bit microcontroller)
  - ↳ (Number of bits in each register) (determine accuracy)
  - ↳ Input/output pins  
Enough pins to support your application
  - ↳ performance  
↳ clock rate are slower
- slow desktop

Arduno = 8bit

- Timer  
Real time application
- A/D  
↳ read in from analog  
↳ sensors
- low power mode
- communication protocol support

AVR - ATmega 2560

- 8 bit
- upto 16 MHz
- 256 KB of flash memory
- 4KB EEPROM, 8KB SRAM
- ↳ peripherals

# storage

#) data is stored in different elements (components)

- ① Register (store single value)  
↳ extremely fast & expensive.

→ EEPROM (general purpose - Mr)

① Register file

② Cache - slower than Register file

→ cheaper, still fairly fast & expensive.

Protocols are the common communication rules for all networks.

# Implement protocol  
(Set of rules)

→ Governs how hosts and routers should cooperate when they transfer data from N/w to N/w.

→ TCP/IP is the global protocol for the global IP internet.  
(common for internet)

→ what does it do?

→ An internet protocol defines a uniform format for host address.

# OSI, divides these tasks b/w N/w abstraction layer.

→ divided into certain layers

### OSI LAYER CONCEPT

→ message is received at each layer, and decisions are made.

→ Assume layer R performs routing transmission

→ Message M is received by layer R.

→ layer R identifies a route for message M.

→ layer R adds routing information creating M'.

→ layer R passes message M' to the next layer.

Protocol stack :- Implementation of each layer. (usually software)

### TCP/IP

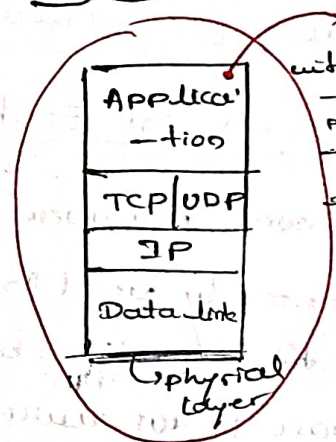
• Transmission Control protocol & Internet protocol.

• TCP/IP used at the transport layer.

### App to App

• IP used at network layer.

### Host to Host



directly connects with applications.  
→ Simple mail transfer protocol (SMTP) (mail)  
→ Hyper-text transfer protocol (web)  
→ Line printer daemon (LPR) - printing

• 4 layer is total, (OSI has 7 layers)

# Adhoc (MANET) mobile, ad-hoc N/w

→ This is the N/w, in which connects by wireless links, often connected to the a wired LAN via an Access point

→ In this connect network will not be stable, and that can be disconnected at any time and can be connected anytime.

# Issues ⇒ data rate & Security

→ wireless bandwidth

demo on # wireshark app 12