



Introduction to Internet of Things (IoT)

Internet of Things

Connecting:



M.Pavankumar

II M.C.A
LBRCE

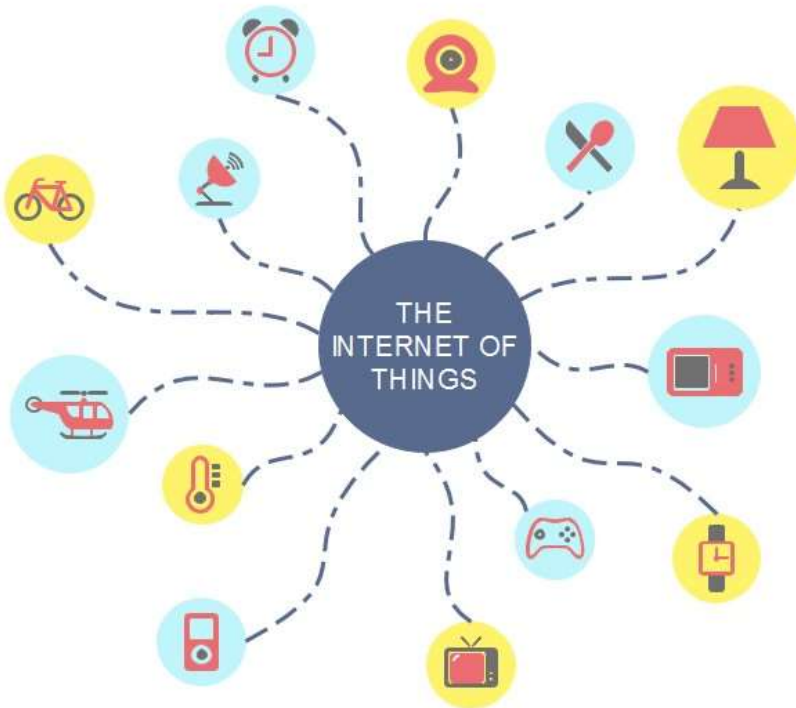
What is IoT?

The Internet of Things (IoT) is the network of physical objects or "things" embedded with electronics, software, sensors, and network connectivity, which enables these objects to collect and exchange data.

What is Internet of Things

- The term **Internet of Things(IoT)** was first suggested by **Kevin Ashton** in **2009**.
- It is used to refer to **uniquely identifiable objects** and their **virtual representations** in an **internet-like structure**.
- If all the objects and people have **identifiers**, they could be **managed** and **inventoried** by computers.
- The world where all objects and people have identifiers and are connected by an internet-like structure is called the **Internet of Things**.

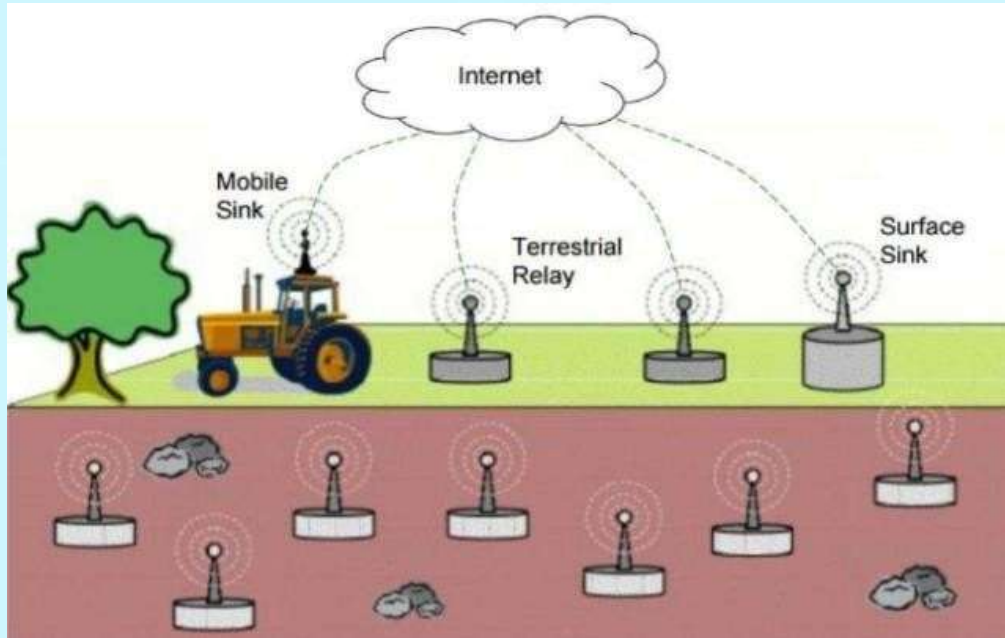
Will have Internet of Things



and Internet of Underground Things



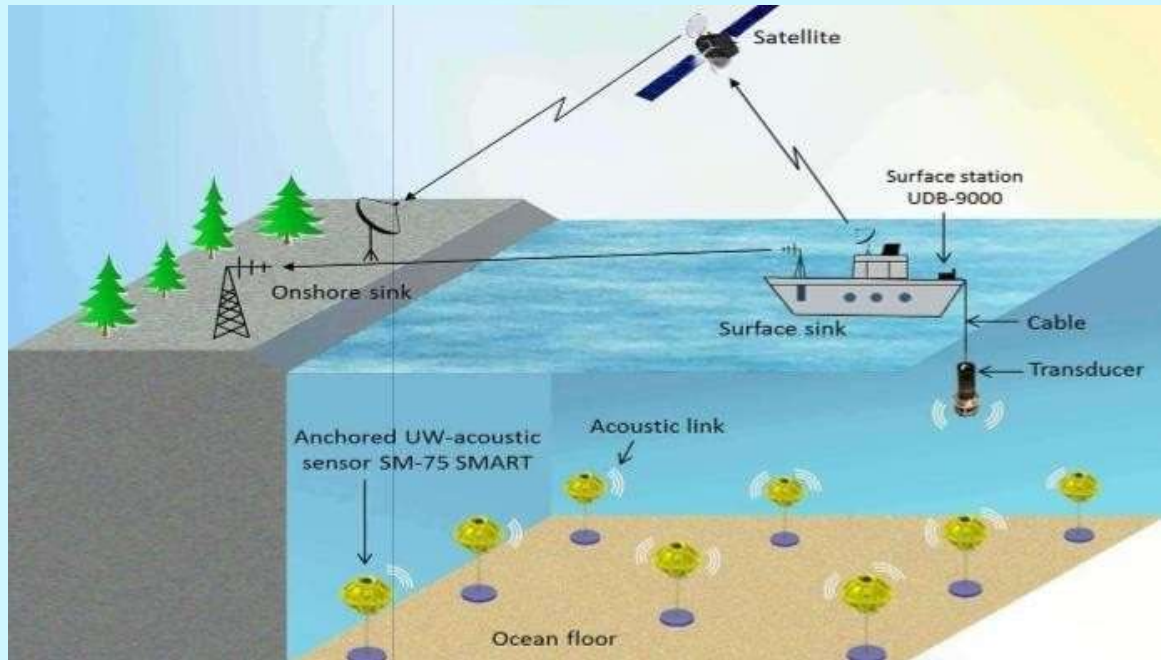
- Yes! IoT is **underground** now!



even Internet of Underwater Things



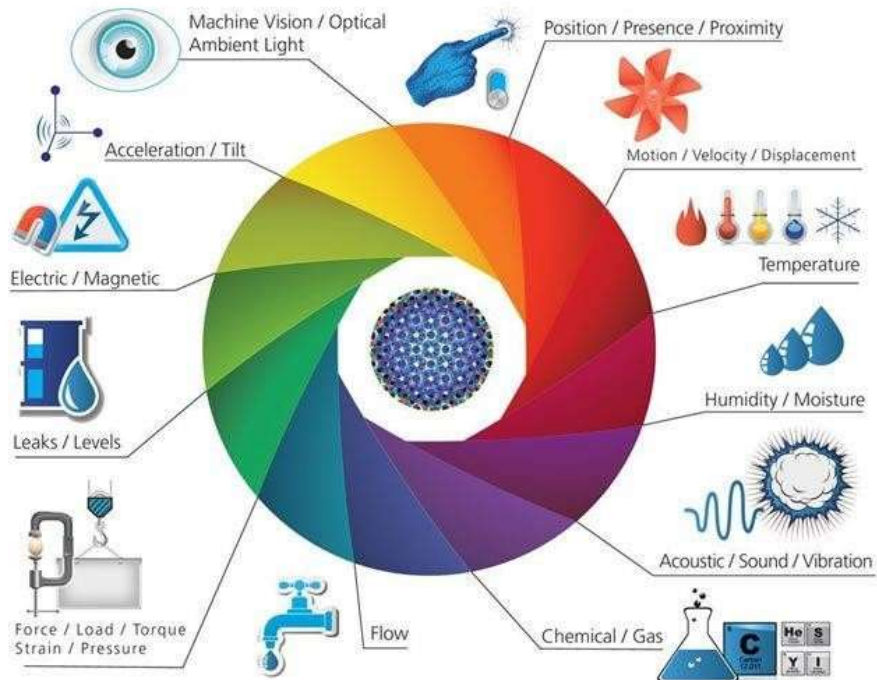
- Even **underwater IoT!**



IoT Devices

1 SENSORS & ACTUATORS

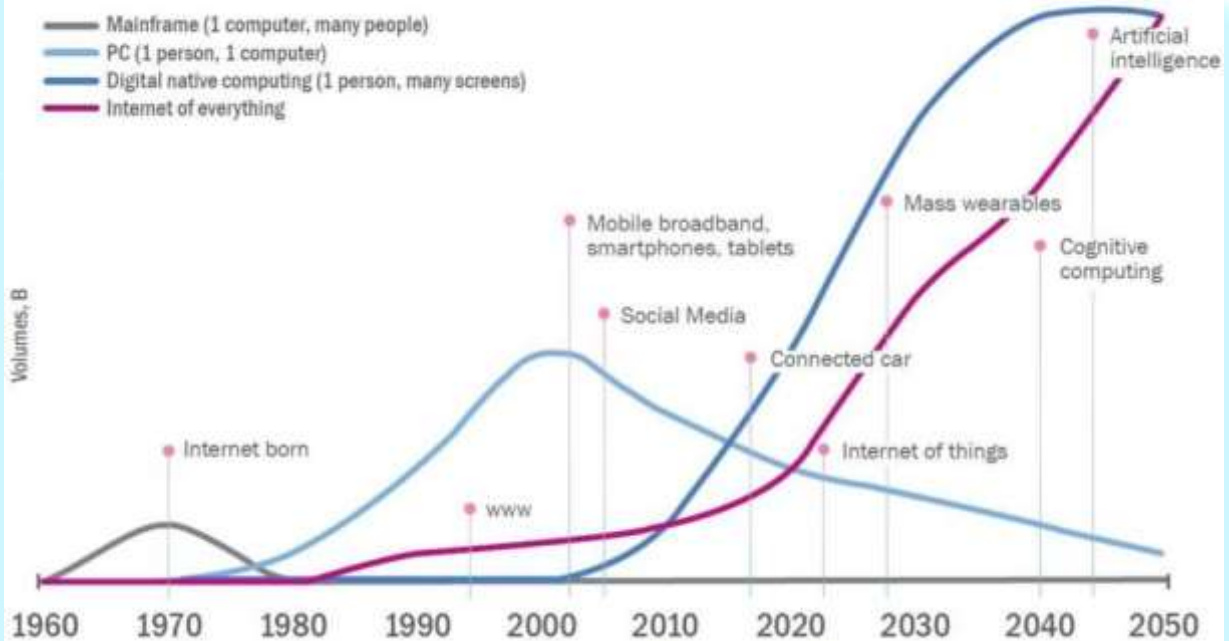
We are giving our world a digital nervous system. Location data using GPS sensors. Eyes and ears using cameras and microphones, along with sensory organs that can measure everything from temperature to pressure changes.



One to Many to Any



One to many to any: ICTs from happy few to the masses



History of IoT



1999

The IoT Gets a Name

Kevin Ashton coins the term “Internet of things” and establishes MIT’s Auto-ID Center, a global research network of academic laboratories focused on RFID and the IoT.

IoT Characteristics

- The *things* should be:
 - Distinguishable and have unique identification
 - Able to detect the presence of other objects
 - Able to capture data **autonomously**.
 - Interoperable among various communication technologies
 - Have a **secure and fail-safe** operation
 - Operate **at low power**.
 - **Programmable** by the user
 - **Contextual** in nature.

IoT Characteristics (Cont.)

There would be more value added if the things

- Have a service–based operation
- Cooperate autonomously with others things

THE INTERNET OF THINGS LIFECYCLE

COLLECT

COMMUNICATE

ANALYZE

ACT

COLLECTION

Devices and Sensors are collecting data everywhere.

- At your home
- In your car
- At the office
- In the manufacturing plant

COMMUNICATION

Sending **data** and events through **networks** to some destination

- A cloud platform
- Private data center
- Home network



ANALYSIS

Creating **information** from the data

- Visualizing the data
 - Building reports
- Filtering data (paring it down)

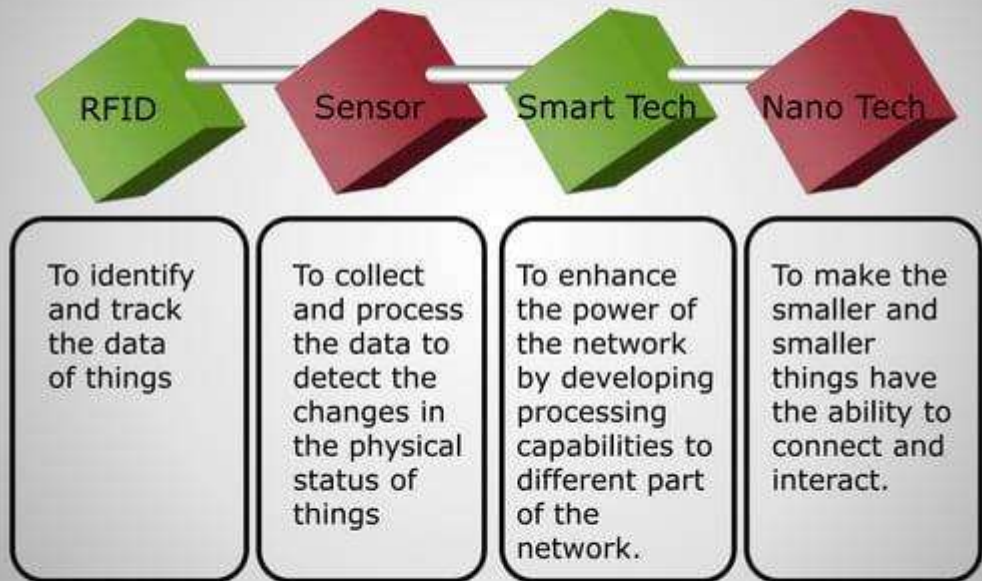


ACTION

Taking **action** based on the information and data

- Communicate with another machine (m2m)
 - Send a notification (sms, email, text)
 - Talk to another system

How IoT Works?



How IoT Works?

The Internet of Things (IoT), also sometimes referred to as the Internet of Everything (IoE), consists of all the **web-enabled devices** that collect, send and act on data they acquire from their surrounding environments using embedded sensors, processors and communication hardware. These devices, often called "connected" or "smart" devices, can sometimes talk to other related devices, a process called **machine-to-machine** (M2M) communication, and act on the information they get from one another. Humans can interact with the gadgets to set them up, give them instructions or access the data, but the devices do most of the work on their own without human intervention. Their existence has been made possible by all the tiny mobile components that are available these days, as well as the always-online nature of our home and business networks.

The Structure of IoT

The IoT can be viewed as a gigantic network consisting of networks of devices and computers connected through a series of intermediate technologies where numerous technologies like RFIDs, wireless connections may act as enablers of this connectivity.

- **Tagging Things** : Real-time item traceability and addressability by **RFIDs**.
- **Feeling Things** : **Sensors** act as primary devices to collect data from the environment.
- **Shrinking Things** : Miniaturization and **Nanotechnology** has provoked the ability of smaller things to interact and connect within the “things” or “smart devices.”
- **Thinking Things** : **Embedded intelligence** in devices through sensors has formed the network connection to the Internet. It can make the “things” realizing the intelligent control.

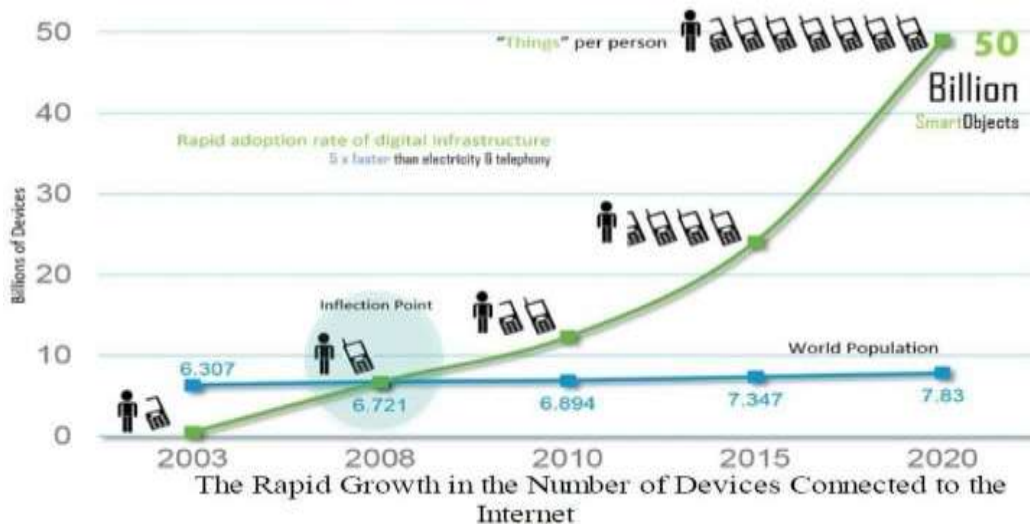
Few Applications of IoT

- ✓ Building and Home automation
- ✓ Manufacturing
- ✓ Medical and Healthcare systems
- ✓ Media
- ✓ Environmental monitoring
- ✓ Infrastructure management
- ✓ Energy management
- ✓ Transportation
- ✓ Better quality of life for elderly
- ✓

You name it, and you will have it in IoT!

IoT Impact

➤ IoT Impact



IoT Impact

- **Connected Roadways- Google's Self-Driving Car**
- **Connected Roadways is a term associated with drivers and driverless cars fully integrating with the infrastructure.**
- **Basic sensors reside in cars monitor oil Pressure, tire pressure, temperature, and other Operating conditions, and provide data about Core car functions.**



Google's Self-Driving Car

IoT Impact

- **Connected Roadways- IoT connected Roadways**
- **Intersection Movement Assist(IMA)**
- **This App warns the Driver when it is not Safe to enter an Intersection due to high Possibility of collision.**



Application of Intersection Movement Assist

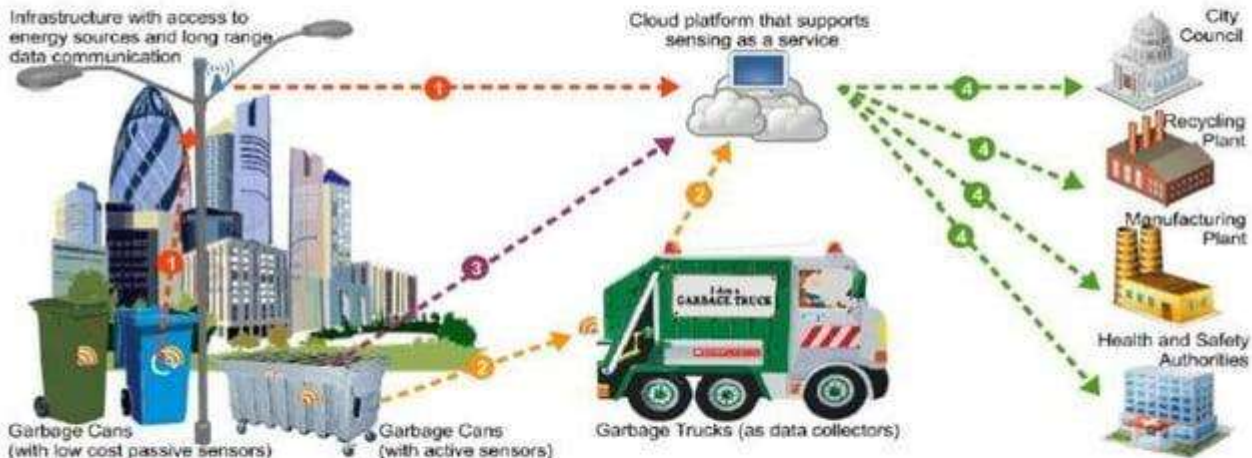
Create **USD 41 Billion** by providing visibility into the availability of parking spaces across the city.



Residents can identify and reserve the closest available space, traffic wardens can identify non-compliant usage, and municipalities can introduce demand-based pricing.

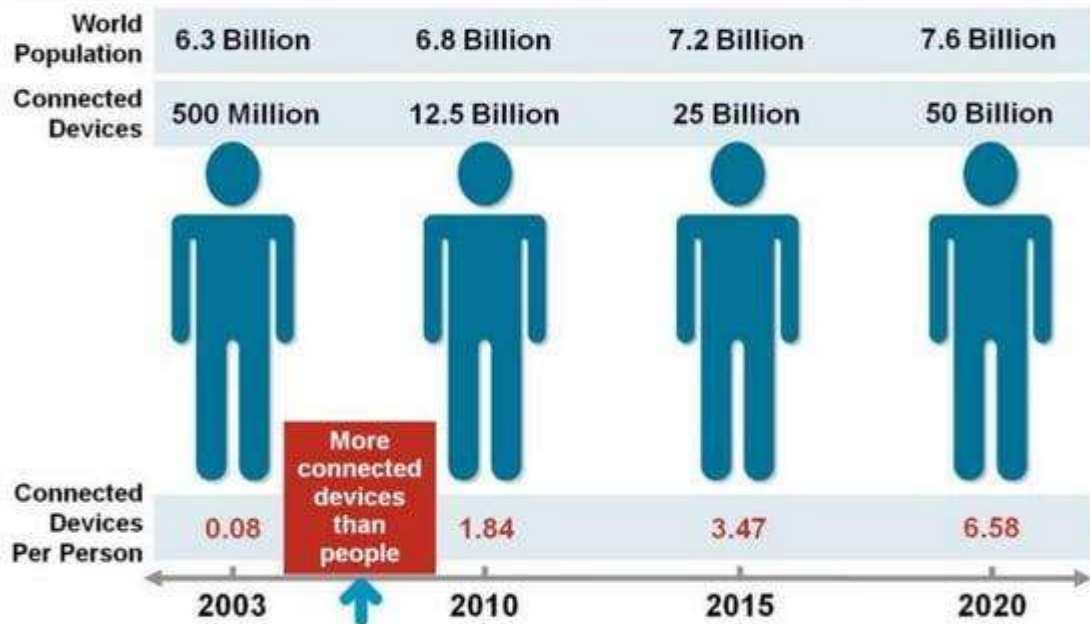
[Source: <http://www.telecomseller.com/2014/01/11/cisco-study-says-ics-can-create-savings/>]

Efficient Waste Management in Smart Cities Supported by the Sensing-as-a-Service



[Source: "Sensing as a Service Model for Smart Cities Supported by Internet of Things", Charith Perera et. al., Transactions on Emerging Telecommunications Technology, 2014]

Current Status & Future Prospect of IoT



“Change is the only thing permanent in this world”

TECHNOLOGICAL CHALLENGES OF IoT

At present IoT is faced with many challenges, such as:

- Scalability
- Technological Standardization
- Inter operability
- Discovery
- Software complexity
- Data volumes and interpretation
- Power Supply
- Interaction and short range communication
- Wireless communication
- Fault tolerance

Criticisms and Controversies of IoT

Scholars and social observers and pessimists have doubts about the promises of the ubiquitous computing revolution, in the areas as:

- Privacy
- Security
- Autonomy and Control
- Social control
- Political manipulation
- Design
- Environmental impact
- Influences human moral decision making

IoT Challenges

- Scalability
- Security -> Chapter 8
- Privacy
- Big Data and Data Analytics
- Interoperability

“Big Data is not magic. It doesn’t matter how much data you have if you can’t make sense of it.”



References

- IoT Fundamentals Book Chapter 1
- Internet