Internet of Everything (IoE)

SENSORS

Sensors
- What are the sensors?
- Sensor Family
- Architecture of a Single Node Sensor.

- **Def:**
  Sensors are sophisticated devices that are frequently used to detect and respond to electrical or optical signals. A Sensor converts the physical parameter (for example: temperature, blood pressure, humidity, speed, etc.) into a signal which can be measured electrically.

  In the broadest definition, a sensor is a device, module, machine, or subsystem whose purpose is to detect events or changes in its environment and send the information to other electronics, frequently a computer processor. A sensor is always used with other electronics.

Criteria to choose a Sensor:
- Accuracy
- Environmental condition – usually has limits for temperature/ humidity
- Range – Measurement limit of sensor
- Calibration – Essential for most of the measuring devices as the reading changes with time
- Resolution – Smallest increment detected by the sensor
- Cost
- Repeatability – The reading that varies is repeatedly measured under the same environment

Classification of Sensors
The sensors are classified into the following criteria:
- Primary Input quantity (Measurand)
- Transduction principles (Using physical and chemical effects)
- Material and Technology
- Property
- Application

Classification based on property is as given below:
- Temperature – Thermistors, thermocouples, RTD's, IC and many more.
- Pressure – Fiber optic, vacuum, elastic liquid-based manometers, LVDT, electronic.
- Flow – Electromagnetic, differential pressure, positional displacement, thermal mass, etc.
- Level Sensors – Differential pressure, ultrasonic radio frequency, radar, thermal displacement, etc.
- Proximity and displacement – LVDT, photoelectric, capacitive, magnetic, ultrasonic.
- Biosensors – Resonant mirror, electrochemical, surface Plasmon resonance, Light addressable potentio-metric.
- Image – Charge coupled devices, CMOS

- Gas and chemical – Semiconductor, Infrared, Conductance, Electrochemical.
- Acceleration – Gyroscopes, Accelerometers.
- Others – Moisture, humidity sensor, Speed sensor, mass, Tilt sensor, force, viscosity.

Classification based on Application is as given below:
- Industrial process control, measurement and automation
- Non-industrial use – Aircraft, Medical products, Automobiles, Consumer electronics, other type of sensors

Classification based on power or energy supply requirement of the sensors:
- Active Sensor – Sensors that require power supply are called as Active Sensors. Example: LiDAR (Light detection and ranging), photoconductive cell.
- Passive Sensor – Sensors that do not require power supply are called as Passive Sensors. Example: Radiometers, film photography.

In the current and future applications, sensors can be classified into groups as follows:
- Accelerometers – These are based on the Micro Electro Mechanical sensor technology. They are used for patient monitoring which includes pace makers and vehicle dynamic systems.
- Biosensors – These are based on the electrochemical technology. They are used for food testing, medical care device, water testing, and biological warfare agent detection.
- Image Sensors – These are based on the CMOS technology. They are used in consumer electronics, biometrics, traffic and security surveillance and PC imaging.
- Motion Detectors – These are based on the InfraRed, Ultrasonic, and Microwave / radar technology. They are used in videogames and simulations, light activation and security detection.

Wireless Sensor Node: