IOTSHOW BENGALURU

Electronics Tech Track:
The Amazing World of SENSORS

Latest Sensors for IoT Hardware

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Agenda

- Type of SENSORS and their importance
- Latest SENSORS for IOT Hardware
- Applications of Sensors in IOT
- IOT use cases
- Integrated solution of IOT
- Future of Sensors in IOT
- Takeaways

Type of SENSORS and their importance

Sensors are devices that detect and respond to changes in an environment.

- Inputs can come from a variety of sources such as light, temperature, motion and pressure.

- Sensors output valuable information and if they are connected to a network, they can share data with other connected devices and management systems.

- They're in our homes and workplaces, our shopping centres and hospitals.

- They're embedded in smart phones and an integral part of the Internet of Things (IoT).

- Sensors have been around for a long time. The first thermostat was introduced in the late 1880s and infrared sensors have been around since the late 1940s.

- The IoT and its counterpart, the Industrial Internet of Things (IIoT), are bringing sensor usage to a new level.

Sensors are the eyes and ears of an IOT or IIOT application and form an integral part of it.

Latest SENSORS for IOT Hardware

10 of the more popular types of IoT sensors and some of their use cases.:

1. Temperature Sensors : Temperature sensors measure the amount of heat energy in a source, allowing them to detect temperature changes and convert these changes to data.

2. Humidity Sensors: These sensors measure the amount of water vapor in the atmosphere of air or other gases. Humidity sensors are commonly found in heating, vents and air conditioning (HVAC).

3. Pressure Sensors: A pressure sensor senses changes in gases and liquids. When the pressure changes, the sensor detects these changes, and communicates them to connected systems.

4. Proximity Sensors: Proximity sensors are used for non-contact detection of objects near the sensor. These types of sensors often emit electromagnetic fields or beams of radiation such as infrared.

5. Level Sensors: Level sensors are used to detect the level of substances including liquids, powders and granular material.

Top 5 :Temperature, Humidity, Pressure , Proximity and Level Sensors.

Latest SENSORS & some of their use cases

1. Temperature Sensors : Machinery often requires environmental and device temperatures to be at specific levels. Similarly, within agriculture, soil temperature is a key factor for crop growth.

2. Humidity Sensors: Used in HVAC systems in both industrial and residential domains. They can be found in many other areas including hospitals, and meteorology stations to report and predict weather.

3. Pressure Sensors: Common use cases include leak testing which can be a result of decay. They are also useful in the manufacturing of water systems as it is easy to detect fluctuations or drops in pressure.

4. Proximity Sensors: In retail, they can detect the motion between a customer and a product in which he or she is interested. The user can be notified of any discounts or special offers of products located near the sensor. They are used in the parking lots of malls, stadiums & airports to indicate parking availability and also used on assembly lines of chemical, food & many other types of industries.

5. Level Sensors: Waste management system provide a common use case as level sensor can detect the level of waste in bin. Used in industries including oil manufacturing, water treatment, Pharma and F&B.

Varied application in Industrial segments such as Machine tools, Defense & Aerospace, Chillers etc..

Latest SENSORS for IOT Hardware (contd)

6. Accelerometers: Accelerometers detect an object's acceleration i.e. the rate of change of the object's velocity with respect to time. Accelerometers can also detect changes to gravity.

7. Gyroscope: Gyroscope sensors measure the angular rate or velocity, often defined as a measurement of speed and rotation around an axis.

8. Gas Sensors: These types of sensors monitor and detect changes in air quality, including the presence of toxic, combustible or hazardous gasses.

9. Infrared Sensors: These type of sensors sense characteristics in their surroundings by either emitting or detecting infrared radiation. They can also measure the heat emitted by objects.

10. Optical Sensors: Optical sensors convert rays of light into electrical signals. Use cases are auto industry, vehicles use optical sensors to recognize signs, obstacles, and other things that a driver would notice when driving or parking.

Rest of 5 : Accelerometers, Gyroscope, Gas, Infrared and Optical Sensors.

Latest SENSORS & some of their use cases

6. Accelerometers: Use cases for accelerometers include smart pedometers and monitoring driving fleets, as anti-theft protection alerting the system if an object that should be stationary is moved.

7. Gyroscope: Use cases include automotive, such as car navigation & electronic stability control (anti-skid) systems. Use cases include motion sensing for video games, and camera-shake detection systems.

8. Gas Sensors: A common consumer use case is the carbon dioxide detectors used in many homes.

9. Infrared Sensors: Used in a variety of different IoT projects including healthcare to simplify the monitoring of blood flow and blood pressure. Televisions use to interpret the signals sent from a remote control. The of art historians using infrared sensors to see hidden layers in paintings to help determine whether a work of art is original or fake or has been altered by a restoration process.

10. Optical Sensors: In the auto industry, vehicles use optical sensors to recognize signs, obstacles, and other things that a driver would notice when driving or parking. Optical sensors play a big role in the development of driverless cars. They are very common in smart phones. For example, ambient light sensors can extend battery life. Also used in the biomedical field: breath analysis & heart-rate monitors.

Varied specialised applications in automotive, entertainment, home automation, healthcare, etc..

Applications of Sensors in IOT

Industrial sensors application

- Milk level in dairies.

- Remote Diesel Tank Level Monitoring.

- Oil level for transformer health.

Hygienic sensors application with IO-Link

- Relative turbidity meter:sensor for low to high turbidity.

- Inductive Conductivity Sensors measurement of liquid media up to 999 mS/cm.

- Continuous level sensor Potentiometric, continuous level measurement for metallic vessels.

- Continuous level sensor with dual probe in metallic or plastic vessels.

HVAC sensors applications

- Control of air supply and temperature-based building management system air-conditioning.

- Pressure sensors maintaining negative/positive pressure based on operation theatre/ isolation ward application.

3 Varieties of sensors based on applications: Industrial , Hygenic and HVAC sensors.

IOT use case- Industrial sensors

Remote Tank Level Monitoring- A Reliable Solution for Real Time Monitoring

- Real time tank level monitoring can be observed through Condition Monitoring System.

- A powerful hardware and software solution which combines flexibility and ease of integration to deliver real time tank level condition alerts in above and below-ground tanks.

- Leak detection, overfill, and idle tank theft are among the various elements tracked through our data analytics software.

- The historic data can be utilized for planning purposes and scheduling critical system alerts when thresholds are met, signalling to a user that an action needs to be taken.

- Tank level monitoring utilizes a level sensor along with a gateway and real time dashboard to provide reassurance and around the clock monitoring to prevent unexpected interruptions and optimize inventory.

Diesel tank level monitoring at a remote telecom tower site to monitor diesel in standby generator.
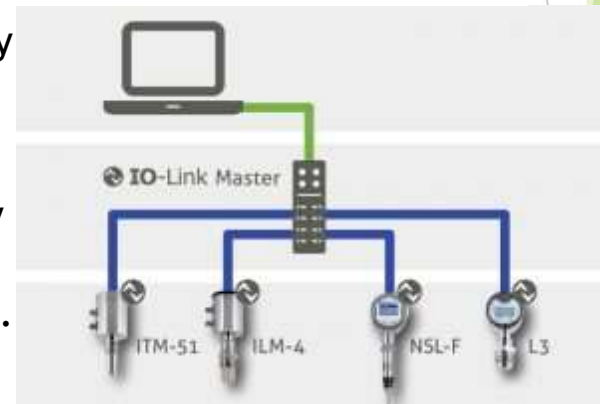
IOT use case- Hygienic sensors

Conductivity sensor with IO-Link

• The conductivity sensor equipped with both digital AND analog interface in parallel. It combines the best of two worlds.

• Digitalization has already found its way into many branches of industry under the keywords "Industry 4.0" or "IOT". Besides to the conventional analog interfaces, it is equipped with the IO-Link in parallel

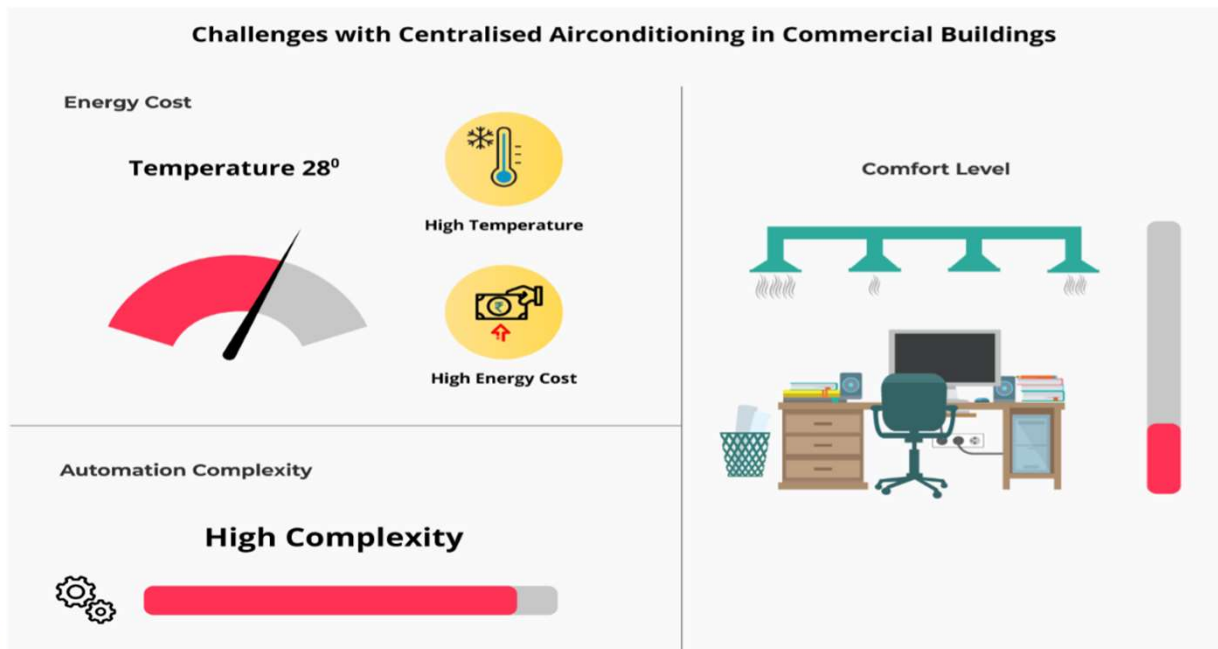The (R)evolution of conductivity measurement

• IO-Link offers significant advantages over analog technology when it comes to reliably controlling the entire process technology with number of measuring points, control & operating elements.

• It is comparable to a multi-lane, bidirectional data highway instead of a narrow one-way street.

• Set-up and installation are extremely time- and cost-saving.

• Simple data transfer becomes intelligent communication

• "Plug-and-play" takes on a whole new meaning

Conductivity sensors find applications in Food and beverage and Pharmaceutical industries
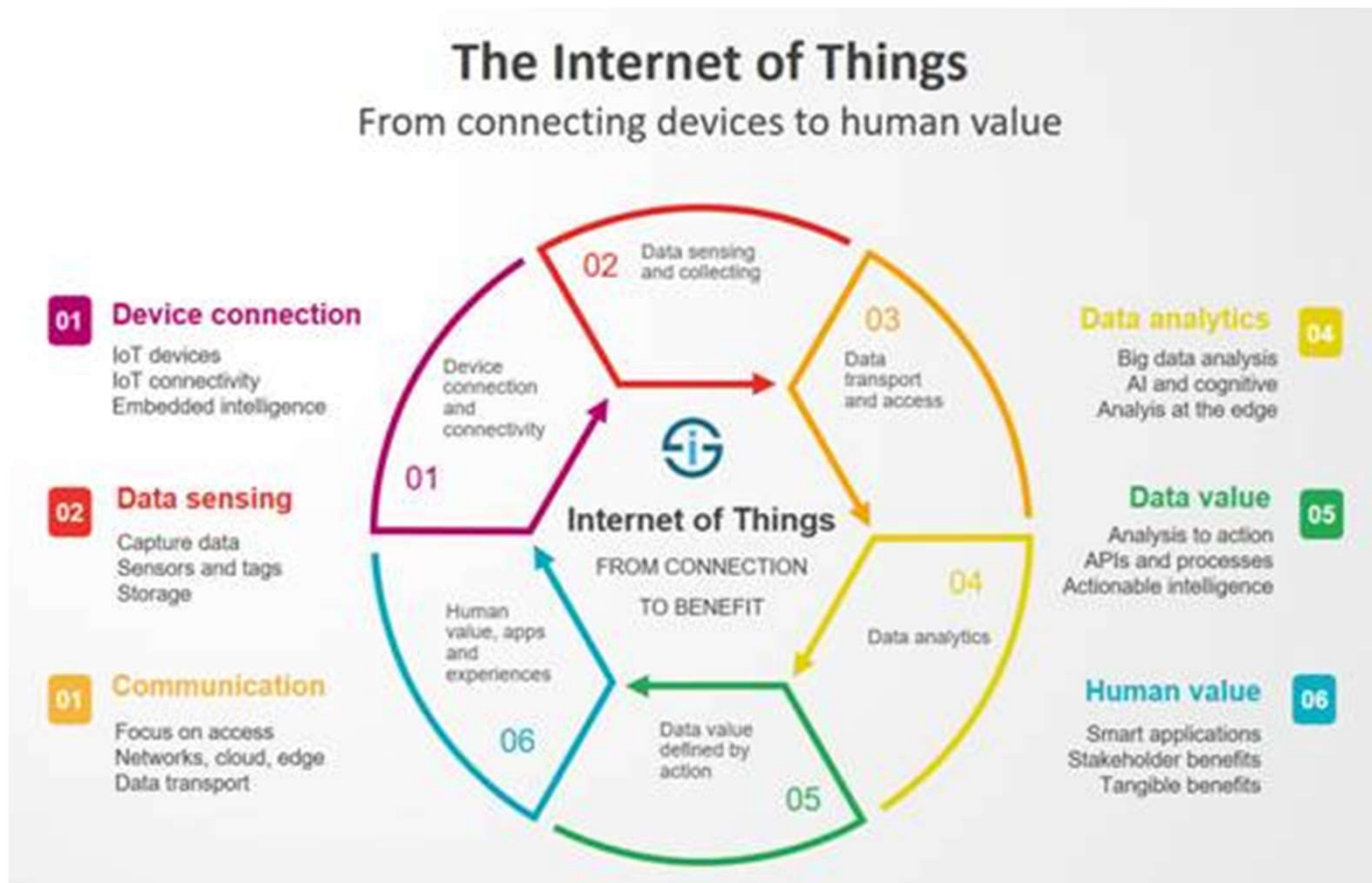
IOT use case- HVAC Sensors

- Control of air supply based on people present in vicinity and temperature based on thermal heat load in building management system centralized air-conditioning

Challenges with Centralised Airconditioning in Commercial Buildings

Energy Cost

Temperature 28°

High Temperature

High Energy Cost

Automation Complexity

High Complexity

Comfort Level

Efficient HVAC Usage & Effective Energy consumption

Reduce electricity consumption costs. Streamline energy efficiencies. Ensure productive workspace.

Integrated solution of IOT

The ecosystem needs more connect between solution provider ie startups and industry ie consumers.
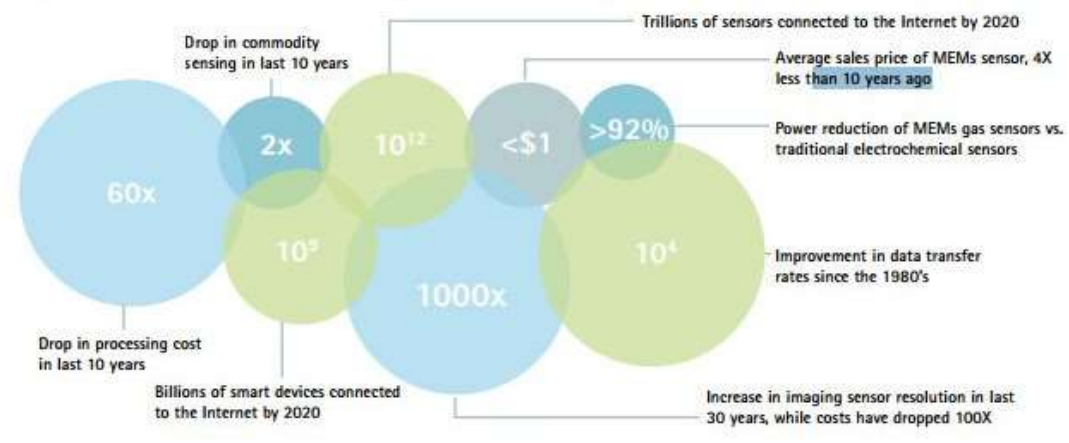
Future of Sensors in IOT

Present and Future MEMS sensors

Technological advancement that enable sensing

Purpose		MEMS/Micro format*	
Basic Sensing	Force	Accelerometer	
	Pressure	Pressure sensors	
	Temperature	Thermocouple	
	Light	Photodetector	
Emulating Human Sensing	Inertia/Orientation	Inertial device, gyroscope,	E-compass
	Touch	Haptic, touch sensors	
	Hearing	Microphones	
	Vision	Image sensors	Micromirrors/lenses, microdisplays, auto-focus
	Speech	Microspeakers	
	Smell	Gas sensors,	e-nose
	Taste	Moisture/humidity	
Uses	Infrared	Microbolometer, IR sensors	
	Ultrasonic	Microphone	
	Radio frequency	Oscillators, tuners, switches	
	Chemistry	Microfluidics, micropumps, biosensors	
	Electrical	Electrode sensors	
	Energy	Energy harvesting, microbatteries	

*Key	Established	Early Commercial	Emerging

Many Possibilities
- Everything can be sensor now
- We can update sensors firmware
- Accessible sensors through hypersense

Futuristic sensors
- "Unobservable" detection sensors
- 3D image sensors
- Depth resolution
- Sensors for detection of elements & atoms
- Self-healing sensors

Sensing is going to evolve rapidly now which has been the case in past too, the key is being "Smart".

Takeaways

- Sensors form an integral part of IOT architecture
- Detect and respond to changes in an environment
- Inputs are motion, temperature , light & pressure
- Other inputs: gas, moisture, angular rate & infrared
- Sensors applications: Industrial, hygienic & HVAC
- The IOT ecosystem is not yet a well-oiled machine
- IOT sensors are getting enabled and becoming smart

Thank You

Any Questions!