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Module - 2

1) Outline of the Difference Between, Transducers, Sensors, and Actuators.

- Sensors :-
  - Devices that detect physical qualities (like temperature, pressure, or light) and convert them into electrical signals for measurement
  - They are primarily input devices.

- Transducers :
  - Devices that convert one form of energy into another. They can include sensors and actuators but are a broader category
  - Example - A microphone (acoustic to electrical), a thermocouple (heat to electrical).

- Actuators :
  - Devices that take an electrical input and convert it into physical action or movement
  - They are primarily output devices

2) Explain Simple Sensing Operation

A sensing operation involves detecting a physical property in the environment and converting it into a measured signal, typically electrical.

For example - a temperature sensor detects the ambient temperature, then generates a corresponding electrical signal that represents the temperature.

The signal can then be sent to a processing unit to interpret or take action based on a measured data.

3 Functional Blocks of a Typical Sensor node in IoT

A typical IoT sensor node includes the following components (like temperature, humidity etc) and converts it to an electrical signal.

Analog to digital Converter - Converts the analog signals from the sensor into digital form for processing.

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Processing Unit - Process the digital data, which may include tasks like filtering, analyzing or compressing data

Communication module : Transmits data to other devices or cloud system using wireless communication protocols

Power source : Provides the energy required to operate the sensor node

4) Sensor characteristics

Sensitivity - The ability of a sensor to detect small changes in measured quality.

Range : The minimum and maximum limits within a sensor can accurately measure

Resolution : The smallest change that a sensor can detect in the measured quality.

Accuracy - The closeness of the sensor's measurement to the actual value

Linearity : The degree to which the output is directly proportional to measured quantity

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1. Electric Actuators:-
   - Operated by an electric signal which is then converted into mechanical movement

   - Examples :- Electric motors, stepper motors, and solenoids

2. Hydraulic Actuators:-
   - Use pressurized fluid to create mechanical motion.

   - Common in heavy machinery like excavators and cranes.

3) Pneumatic Actuators
   - Use compressed air to produce movement

   - Often found in industrial system such as automation and robotics.

4) Thermal Actuators:-
   - Use thermal energy to cause expansion or contraction, which leads to movement

   - Examples include thermally controlled valves and shape memory alloys.

5 magnetic Actuators

Response Time: The time taken by sensor to respond to a change in the measured quantity.

Repeatability: The sensor's ability to produce consistent output under the same conditions.

Stability: The ability of the sensor to maintain consistent performance

5) what are actuators? Explain its types

Actuators:

- Devices that receive an electrical signal and convert into physical movement or action.

- They are used to influence a physical system or environment based on a control signal.

Types of actuators:-

- Utilize magnetic fields to create motion, typically seen in applications requiring precision

- Example: voice coil actuators and magnetic latching actuators.