SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

19EET304/ IOT for Electrical Sciences

III YEAR VI SEM

UNIT 2 – SENSORS

TOPIC 2 – ANALOG AND DIGITAL SENSORS, INDUCTIVE SENSORS: SENSITIVITY AND LINEARITY OF THE SENSOR

Sensors in IoT

A sensor is a device that takes physical input from its surroundings and turns it into data that can be analyzed by humans or machines. The majority of sensors are electronic (the data is transformed into electronic data), although others are simpler, such as a glass thermometer that displays visual data.

Depending on the type of input, sensors can broadly be divided into two categories:

Analog Sensors

Digital Sensors

The Internet of Things (IoT) provides many opportunities to improve how businesses operate. IoT has enhanced the automation processes by collecting massive amounts of data via sensors.

The sensors are able to gather data and send it either directly or indirectly to the cloud or the edge. These sensors are also useful as standalone devices with processing and important communication capabilities.

Data collected from sensors also helps businesses to make intelligent decisions about their operations.

ANALOG SENSORS VS DIGITAL SENSORS

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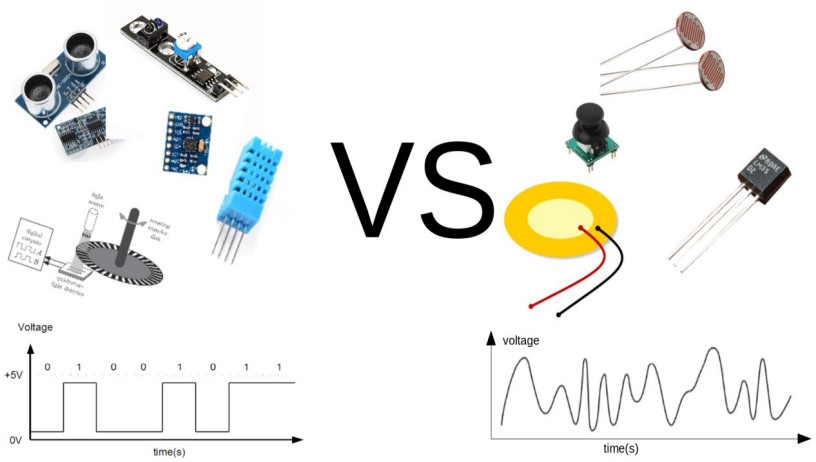

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Analog Sensors

Digital Sensors

ANALOG SENSORS VS DIGITAL SENSORS

In analog sensors, the sensor's reaction or output is a continuous function of one or more of its input parameters. But, a digital sensor has a binary-based response.

- digital sensors produce a discrete digital voltage or signal that is considered to be a digital representation of a measurement.
- This sensor will display binary output in ones and zeros.
- Digital sensors tend to be considerably less expensive when compared to analog ones. These sensors are known to have a fast transmission rate as well as negligible distortion.
- They don't have the same limitations as analog sensors.
- pH levels, ammonium concentration, nitrate concentration, and dissolved oxygen

ANALOG SENSORS VS DIGITAL SENSORS

Factors	Analog Sensors	Digital Sensors
Data Transmission	Deterioration by noise	Noise immune without deterioration
Signal	Continuous Signal is representing physical measurements	Digital signal representing discrete-time signals generated by digital modulation
Bandwidth	Lower Bandwidth	Higher Bandwidth
Power	Takes large power	Negligible Power
Waves	Represented by Sine Waves	Denoted by Square Waves
Impedance	Impedance is Low	High Impedance of order 100 megaohm
Errors	Observational error occurs	Free from Observational error

APPLICATIONS OF DIGITAL SENSORS

•Water and industrial processes are the most common applications for digital sensors. pH, redox potential, conductivity, dissolved oxygen, ammonium, nitrate, SAC, and turbidity are among the characteristics they monitor.

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•These are implemented in cell phones and other internet-connected devices.

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•In-game controllers and computer components.

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•Used in the healthcare profession.

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•Personal navigation equipment is also equipped with this technology

APPLICATIONS OF ANALOG SENSORS

- Speakers
- Ultrasonic distance sensors
- Light sensors
- Ultraviolet light sensors
- Flex sensors
- Transistors
- Force-sensitive sensors

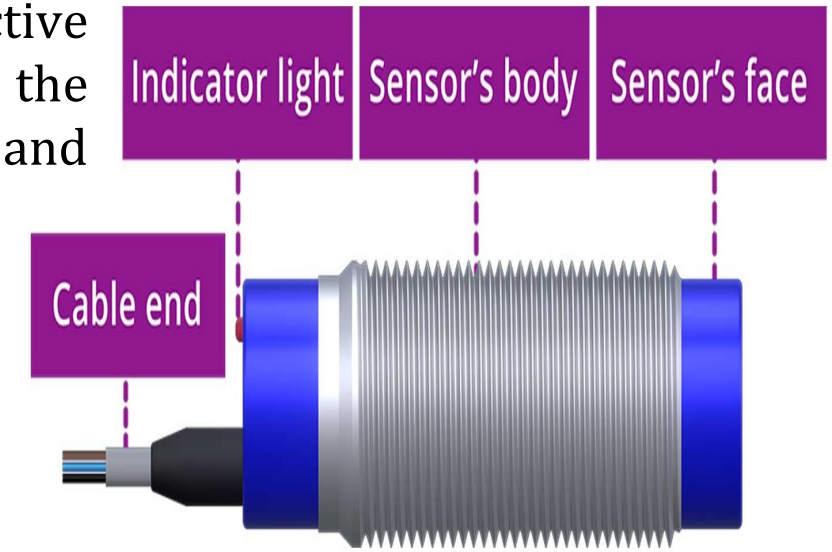
WHAT IS AN INDUCTIVE SENSOR?

•An inductive sensor is an electronic device that can detect ferrous metal targets without physical contact.

•Inductive sensors will also detect non-ferrous metal targets like aluminum, brass, and copper. But using non-ferrous metal targets decreases an inductive sensor's sensing range.

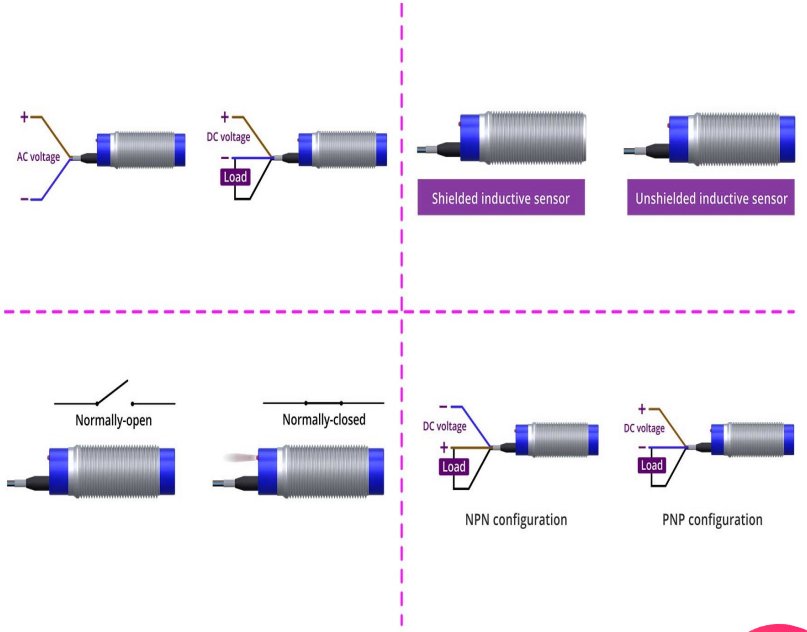
INDUCTIVE SENSOR PARTS

The four major external parts of an inductive sensor are the body of the sensor, the sensor's face, the indicator light, and the cable end or cable connector end.



TYPES OF INDUCTIVE SENSORS

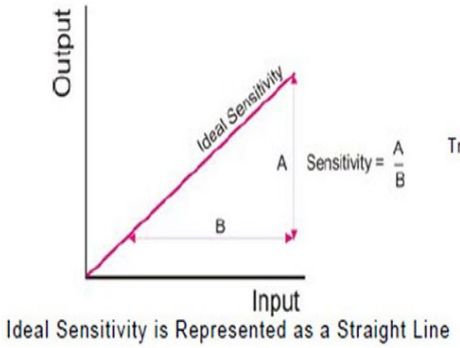
Inductive sensors are available in a lot of different configurations. They can be
– AC or DC,
– shielded or unshielded,
– normally open or normally closed,
– NPN or PNP, just to name a few.



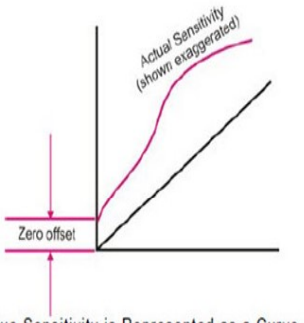
SENSITIVITY AND LINEARITY OF THE SENSOR

A sensor's sensitivity indicates how much its output changes when the input quantity it measures changes. For instance, if the mercury in a thermometer moves 1 cm when the temperature changes by 1 °C, its sensitivity is 1 cm/°C (it is basically the slope dy/dx assuming a linear characteristic).

Linearity is an indicator of the consistency of measurements over the entire range of measurements. In general, it is a good indicator of performance quality of a sensor, but on its own, it can be a misleading indicator. In simple terms, linearity tells us how well the instrument measurement corresponds to reality.



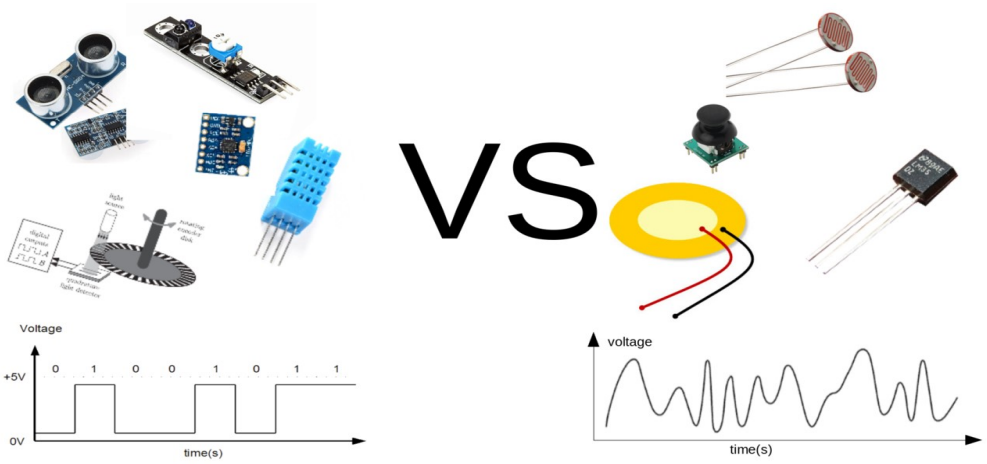
Ideal Sensitivity is Represented as a Straight Line



True Sensitivity is Represented as a Curve

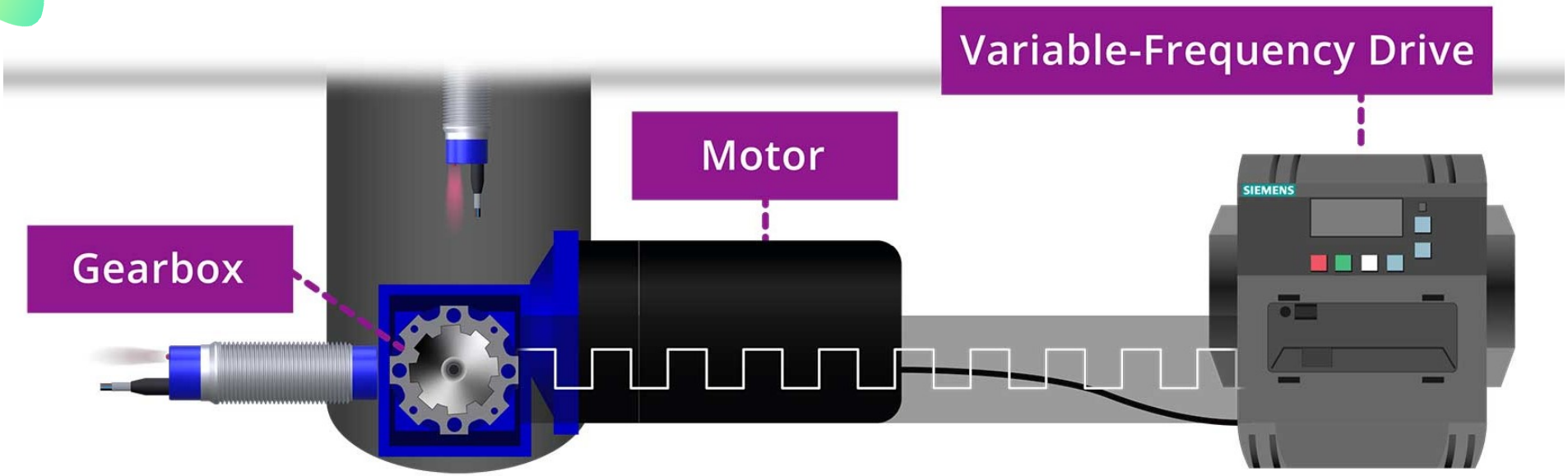
ASSESSMENT – 1

HOW CAN YOU TELL IF A SENSOR IS DIGITAL OR ANLOG ?



ASSESSMENT – 2

How does an inductive sensor work?



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