Internet of Things

S.Y.B.Sc Computer Science

Sensing: Sensors and Transducers

Introduction

- Measurement is an important subsystem in any major system.
- A measurement system consists of sensors, actuators, transducers and signal processing devices.
- The use of these elements and devices is not limited to measuring systems.

Sensor and Transducer Definitions

- The words sensors and transducers are widely used in association with measurement systems.
- **The sensor** is an element that produces signals relating to the quantity that is being measured.
- According to Instrument Society of America, "**a sensor is a device that provides usable output in response to a specified quantity which is measured**."
- The word sensor is derived from the original meaning '**to perceive**.'

- Sensors are devices that perform input function in a system as they '**sense**' the changes in a quantity.
- A sensor converts a physical event into an electrical signal.
- Sensors are used at input of a system.
- **Transducers** are the devices that convert energy in one form into another form.
- Transducer is a term collectively used for both sensors and actuators.

Basic Requirements of a Sensor or Transducer

- Range
- Accuracy
- Sensitivity
- Stability
- Repeatability
- Response time
- Linearity

Classification of Transducers

- Input transducers - takes one form of energy and converts it into electrical signals.(ex. Microphone)
- Output transducers - take electrical signals and convert them into another form of energy.(ex. Lamp)

There are other different types of transducer depending on what measurements are required.

- **Pressure transducers**
- **TemperatureTransducers**
- **Position Transducers**

Commonly used Sensors and Transducers

- For sensing light
- For sensing temperature
- For sensing position
- For sensing pressure
- For sensing sound
- For sensing speed

Classification of Sensors

- **Active Sensors -** require an external excitation signal or a power signal.
- **Passive Sensors -** do not require any external power signal and directly generates output response.
- Some sensors are also classified based on **detection** and **conversion** phenomenon.

Different Types of Sensors

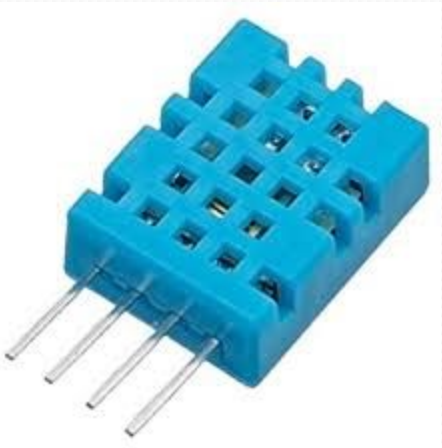
- Temperature Sensors
- Humidity Sensors
- Pressure Sensors
- Proximity sensors
- Level Sensors
- Accelerometers
- Gyroscope
- Gas Sensors

1.Temperature sensor

- Measure the amount of heat energy in a source,
- Allowing them to detect temperature changes
- Convert these changes to data.

2. Humidity Sensors

- Measure the amount of water vapor in the atmosphere of air or other gases
- Commonly found in heating, vents and air conditioning (HVAC) systems



3. Pressure Sensors

- Senses changes in gases and liquids
- When the pressure changes, the sensor detects these changes, and communicates them to connected systems

4. Proximity Sensors

- Used for non-contact detection of objects near the sensor.
- Emit electromagnetic fields or beams of radiation such as infrared.

5. Level Sensors

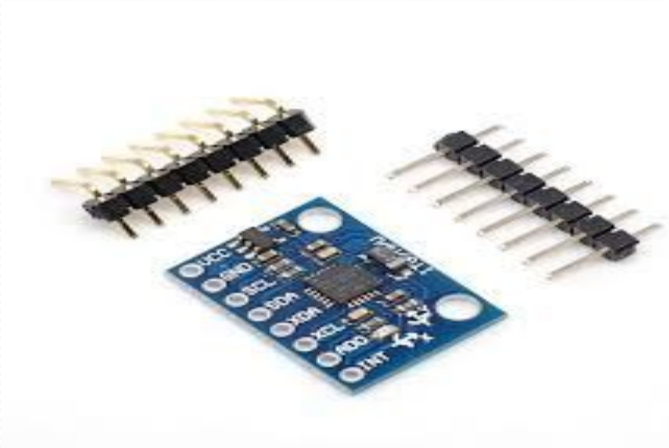
- Detects the level of substances including liquids, powders and granular materials.

6. Accelerometers

- Detects an object's acceleration i.e. the rate of change of the object's velocity with respect to time.
- Also detect changes to gravity.

7. Gyroscope

- Measure the angular rate or velocity,
- Often defined as a measurement of speed and rotation around an axis.



8. Gas Sensors

- Monitor and detect changes in air quality, including the presence of toxic, combustible or hazardous gases.

9. Infrared Sensors

- Sense characteristics in their surroundings by either emitting or detecting infrared radiation.
- Measure the heat of an object as well as detects the motion.

10. Optical Sensors

- Convert rays of light into electrical signals.
- It measures the physical quantity of light and then translates it into a form that is readable by an instrument.