DRIVES

Development and Research on Innovative Vocational Education Skills

# SENSOR FUSION EXPERT

## SFE.U2.E2 TYPES OF SENSORS

Essential Sensor Foundations

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# LEARNING OBJECTIVES

The student is able to …

| | |
|---|---|
| SFE.U2.E2.PC1 | The student understands the different classifications of sensors. |
| SFE.U2.E2.PC2 | The student knows how to properly classify a sensor. |

# CLASSIFICATION OF SENSORS

## *Classification of Sensors*

- Sensors can be classified in many ways and there are many ways to classify them.
- In this slide we will demonstrate those that are essential for the subject in question.
- For this, the sensors can be classified from:
  - Be active
  - Be passive
  - The Output Signal Type
  - By Physical Parameters

# CLASSIFICATION OF SENSORS

*Classification of Sensors*

- Active Sensors
  - These are all sensors that need an external excitation signal or a power signal.
- Passive Sensors
  - These sensors do not require any external signal and generate a response directly.

# CLASSIFICATION OF SENSORS

*Sensor Output Signal Classification*

- Regarding the sensor output signals, they can be classified in two ways:
  - Analog Output
  - Digital output

# CLASSIFICATION OF SENSORS

*Sensor Output Signal Classification*

- Regarding the sensor output signals, they can be classified in two ways:
  - Analog Output
    - This output is determined by the (analog) voltage that can be measured using a physical parameter and using the sensor transfer function.
    - It can be capacitive, resistive or anything analog.

# CLASSIFICATION OF SENSORS

*Sensor Output Signal Classification*

- Regarding the sensor output signals, they can be classified in two ways:
  - Digital output
    - The output format of these sensors are elaborated by digital data, so that they can be read via buses, whether in series or parallel.
    - The format of this type of data is shown in the sensor data sheet
      - A good example of these sensors is the accelarometer, which sends output data via a two-wire I2C bus.

# CLASSIFICATION OF SENSORS

*Classification of physical parameters of the sensor*

- Other ways that sensor classification can exist is sensor-based detection means.
- These means of detection can be:
  - Biological
  - Chemicals
  - Radioactive
  - Electric

# CLASSIFICATION OF SENSORS

*Classification of physical parameters of the sensor*

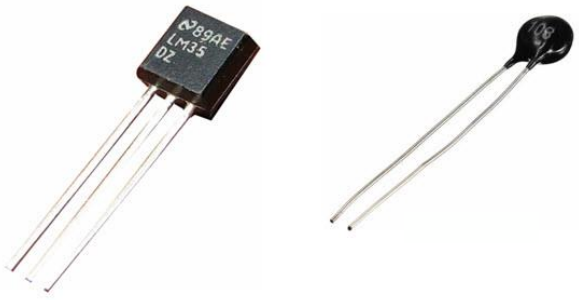
- There are several types of sensors that you can choose for the effect you want, namely:

  - **Temperature**
  - **Light**
  - **Humidity**
  - Speed
  - LIDAR
  - **Inclination**
  - Vibration
  - Pressure
  - **Ultrasonic**
  - Sound
  - **Proximity**
  - Magnetic
  - Gyroscope
  - **Infrared**
  - GPS
  - Accelerometer

# CLASSIFICATION OF SENSORS

*Classification of physical parameters of the sensor*

- There are several types of sensors that you can choose for the effect you want, namely:
  - **Temperature**
    - This is a sensor that detects temperature and measures these changes in temperature;
    - These sensors can be analog or digital
    - The LM35 is a classic analog temperature sensor and the DS18B20 is a simple digital temperature sensor



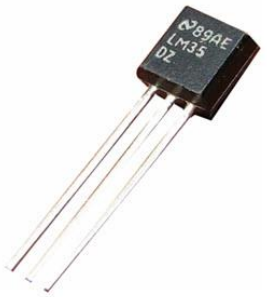

LM35 - Temperature Sensor IC

10KΩ NTC Thermistor

# CLASSIFICATION OF SENSORS

*Classification of physical parameters of the sensor*

- There are several types of sensors that you can choose for the effect you want, namely:
  - **Temperature**
    - These sensors can be used in cars, computers, cell phones, air conditioning systems, in industry, among others.



LM35 - Temperature Sensor IC


10KΩ NTC Thermistor

# CLASSIFICATION OF SENSORS

*Classification of physical parameters of the sensor*

- There are several types of sensors that you can choose for the effect you want, namely:
  - Proximity
    - Detects the presence of a certain object
    - It can be implemented using several techniques:
      - Optics (IR or Laser)
      - Sound (Ultrasonic)
      - Magnetic
      - Capacitive


Inductive Proximity Sensor

# CLASSIFICATION OF SENSORS

*Classification of physical parameters of the sensor*

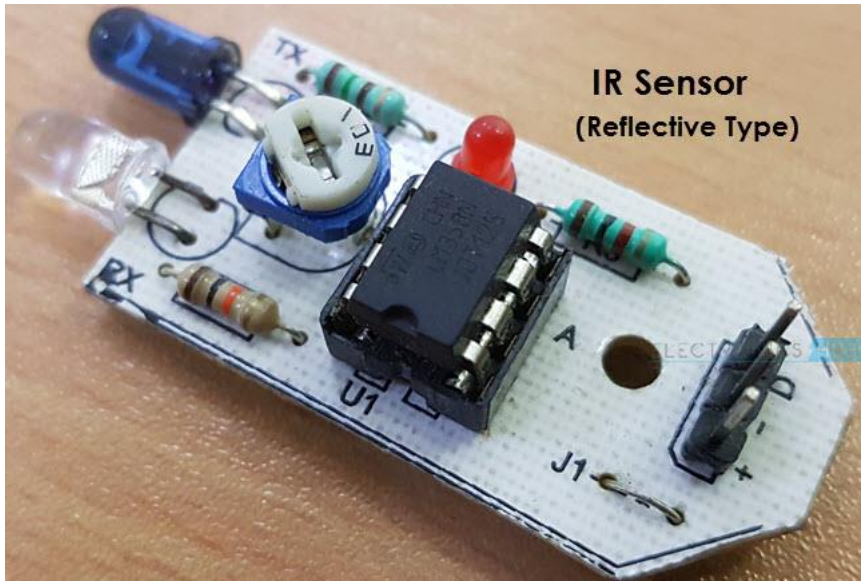
- There are several types of sensors that you can choose for the effect you want, namely:
  - Proximity
    - Some of your applications might be:
      - Smartphones
      - Cars (parking sensors)
      - Industries (object alignment)
      - Proximity to the ground in aircraft
      - Between others


Inductive Proximity Sensor

# CLASSIFICATION OF SENSORS

*Classification of physical parameters of the sensor*

- There are several types of sensors that you can choose for the effect you want, namely:
  - Infrared
    - Are light-based sensors
    - There are two types of IR sensors
      - Transmissives
      - Reflective



# CLASSIFICATION OF SENSORS

*Classification of physical parameters of the sensor*

- There are several types of sensors that you can choose for the effect you want, namely:
  - **Infraered**
    - Transmissives
      - It is positioned face to face with an IR emitter and receiver so that when an object passes through the fixture, it emits a signal.
    - Reflective
      - They are positioned adjacently so that when the object is positioned in front of the sensor the light from the IR sensor reflects off the object and is detected by the emitter.

# CLASSIFICATION OF SENSORS

*Classification of physical parameters of the sensor*

- There are several types of sensors that you can choose for the effect you want, namely:
    - Infrared
        - Are used in:
            - Smartphones
            - Robots
            - Industry
            - Car
            - Between others

# CLASSIFICATION OF SENSORS

*Classification of physical parameters of the sensor*

- There are several types of sensors that you can choose for the effect you want, namely:
  - Ultrasonic
    - Can measure the distance of an object using waves (similar to SONAR)
    - Can be used to measure object velocities

Ultrasonic Sensor

# CLASSIFICATION OF SENSORS

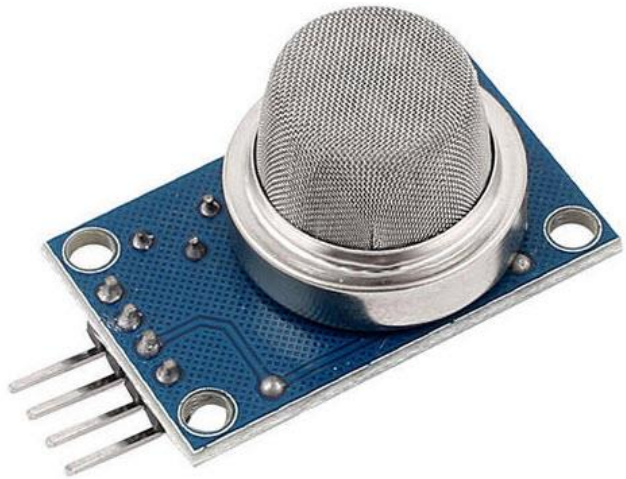
*Classification of physical parameters of the sensor*

- There are several types of sensors that you can choose for the effect you want, namely:
  - Light
    - Known as photosensors
    - They are the most important sensors
    - The light-dependent resistance or LDR is one of the most used sensors today
    - Evaluates the light intensity and as it increases the resistance decreases

# CLASSIFICATION OF SENSORS

*Classification of physical parameters of the sensor*

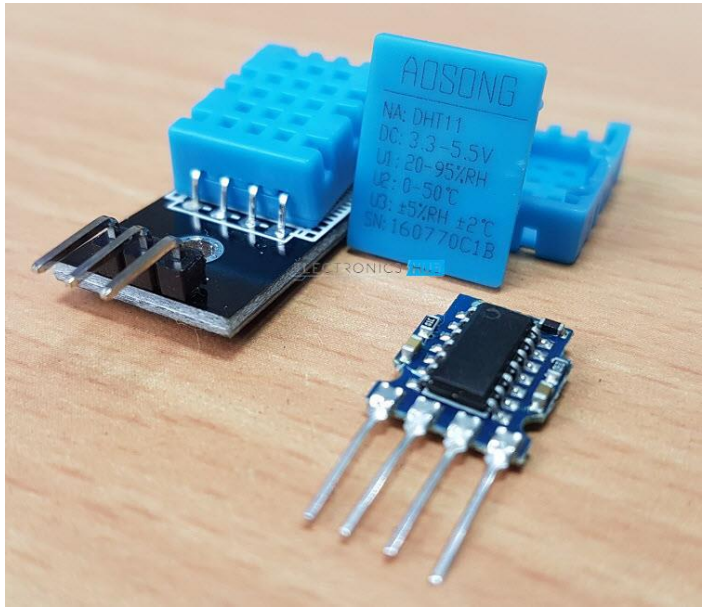
- There are several types of sensors that you can choose for the effect you want, namely:
  - Smoke and Gas Sensors
    - They are usually installed in homes or industry to make them safer as a safety mechanism.



# CLASSIFICATION OF SENSORS

*Classification of physical parameters of the sensor*

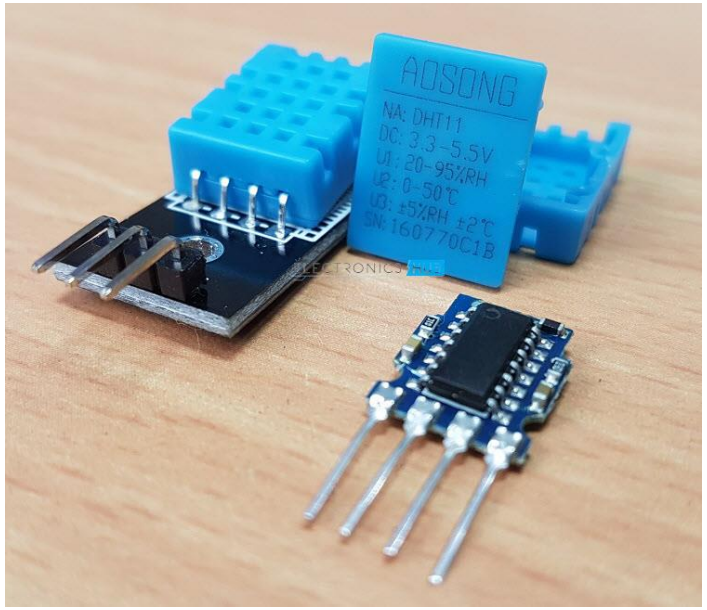
- There are several types of sensors that you can choose for the effect you want, namely:
  - Humidity Sensors
    - These sensors could be used to monitor the climate.
    - They usually provide temperature and humidity data
    - In general these sensors measure the relative humidity and as the relative humidity depends on the air, all these sensors can also measure the temperature.



# CLASSIFICATION OF SENSORS

*Classification of physical parameters of the sensor*

- There are several types of sensors that you can choose for the effect you want, namely:
  - Tilt Sensors
    - These sensors are widely used to detect tilt and orientation.
    - They were formerly used with mercury and currently have a sphere
    - As a rule, its use is simple and it is a relatively inexpensive sensor.



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DRIVES

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# Thank you for your attention

DRIVES project is project under **The Blueprint for Sectoral Cooperation on Skills in Automotive Sector**, as part of New Skills Agenda.

The aim of the Blueprint is **to support an overall sectoral strategy and to develop concrete actions to address short and medium term skills needs.**

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