DRIVES

Development and Research on Innovative Vocational Education Skills

SENSOR FUSION EXPERT

SFE.U2.E1 SENSORS BASICS:

DEFINITION, FUNCTIONS AND FEATURES

Essential Sensor Foundations

JUNE 2021, Version 1

Co-funded by the Erasmus+ Programme of the European Union

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LEARNING OBJECTIVES

The student is able to …

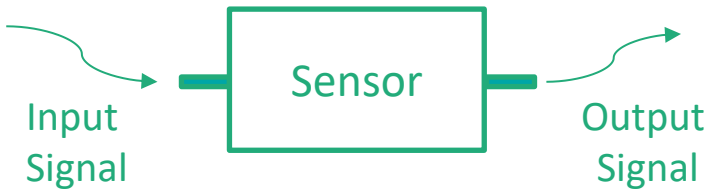
SFE.U2.E1.PC1	The student understands the nature, purpose, and particularities of sensors.
SFE.U2.E1.PC2	The student can list and describe the main functionalities of sensors.
SFE.U2.E1.PC3	The student is able to define the key features of sensors.

SENSORS - DEFENITION

Defenition

- What is a sensor?

- A sensor is a type of device that through a physical impulse can respond to it through another impulse.
- In other words, they are devices capable of responding to a given stimulus with an action.
- Sensors have the function of converting a certain physical or chemical quantity to an electrical quantity.



SENSORS - PURPOSE

Purpose of Sensors

- In the same way that we humans have sensors that can sense if a certain body is hot or cold, a machine can also have sensors to give it “senses” to certain systems.

- Basically, this is the purpose of the existence of sensors, that is, to allow a given machine to have sensitivity capabilities for a given environment.

SENSORS - FEATURES

Examples of Sensors

- There are different types of sensors and these have different types of functions. As such, we present those who may have some relevance to the course in question, namely:
  - Acoustics (sound)
  - Accelerometers;
  - LIDAR
  - Gyroscope

SENSORS - FEATURES

Acoustic Sensors

- These sensors are well known for being used to measure distances!
- This is because they use the return of the sent signal (echo) to calculate the distances.
- This sensor can be used in the Parking System in newer cars;
- These sensors work with a Sonar System

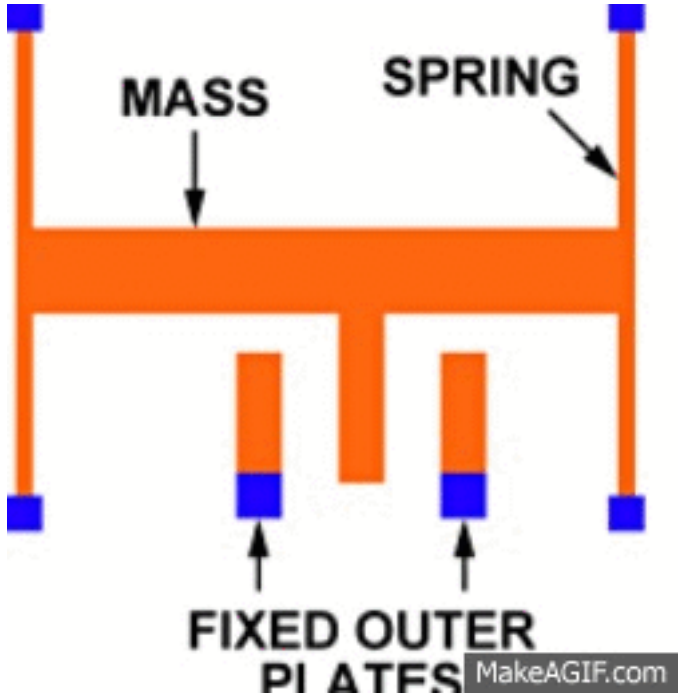
SENSORS - FEATURES

Accelerometer

- An accelarometer is a device that serves to measure acceleration;
- These can be used to measure vibration, shock, motion, seismic, force and tilt.

Accelerometer

- The accelarometer works when a mass that has been mounted on a spring is damped.
- As soon as this mass is placed with acceleration, it will move. The process of that displacement will be converted into useful units.



Accelerometer

- **There are two types of accelarometers:**
  - AC accelarometers
    - They are used to measure dynamic events, that is, they cannot measure direct current (DC) or static acceleration.
  - DC accelarometers
    - They can measure static acceleration very effectively, but they can also measure dynamic vibration (AC)
      - As a rule, there is no large AC bandwidth

SENSORS - FEATURES

LIDAR

- The acronym deal stands for Light Detection And Ranging
- This technology aims to measure the distance between objects.
- Can be used to define measures
- For the sensor to know these measurements it uses light.
- One of the main benefits is that it is a sensor that consumes few energy resources.
- It can be used in several areas, but the most common are vehicles and aircraft.

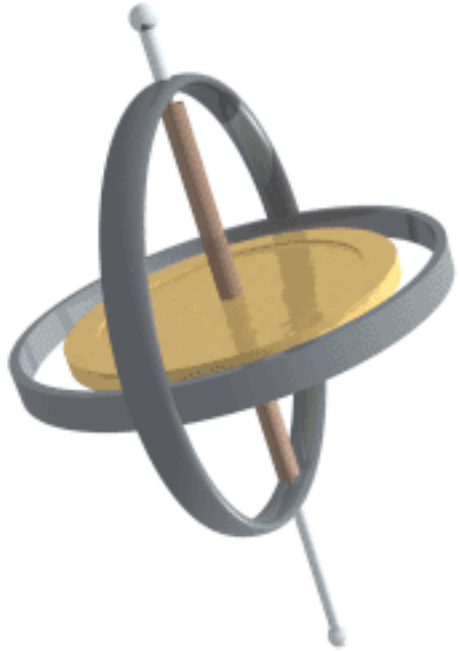
SENSORS - FEATURES

LIDAR

- For the car this sensor is like an integral part of your vision system.
- This sensor can detect obstacles and at the same time, based on that information, it can serve as a guidance system.
- Currently, the entire autonomous vehicle and agricultural machinery industry is using these sensors for accident prevention.

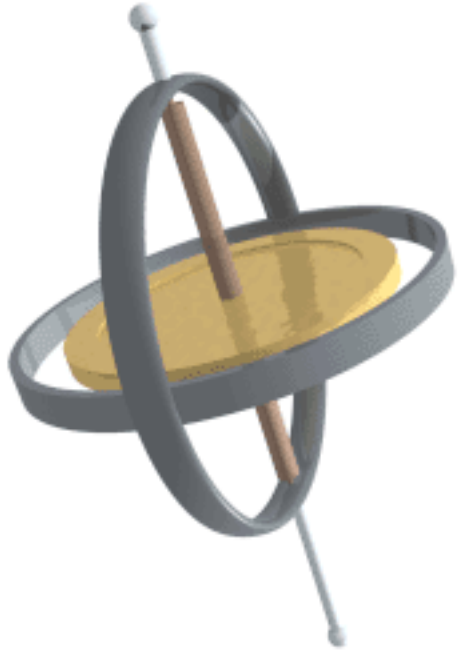
Gyroscope

- In practice, a gyroscope is still a MEMS sensor - Micro-Electro-Mechanical System.
- The Gyroscope essentially serves to generate an angular movement through energy, so that when a certain object moves, the sensor will indicate that it has had a movement.



Gyroscope

- Thus, at the automotive level, its usefulness can be, namely, for navigation.
- For example, autopilots, already existing in aviation, use gyroscopes to steer them without the help of people.

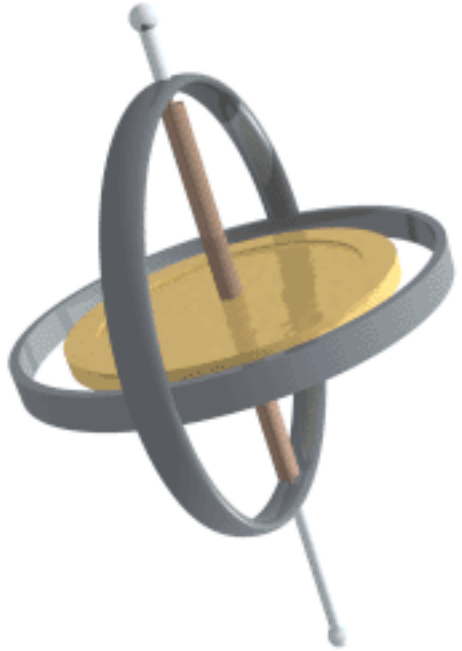


Gyroscope

- There are two types of gyroscopes:
  - Mechanical Gyros
  - Optical Gyros

Gyroscope

- There are two types of gyroscopes:
  - Mechanical Gyros
    - They are the oldest gyroscopes, the wheel rotates with great speed when attached to a support. As a rule, an electric motor is required to keep it turning.



Gyroscope

- There are two types of gyroscopes:
  - Optical Gyros
    - Instead of having a spinning wheel, there are lasers that replace it.
    - Two lasers produce rays that pass through a tube in opposite directions.
    - These rays hit a sensor. If there is an inclination, one of the rays will take a little longer to reach the sensor and there will be obtained values to be considered as variations.

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UMINHO – University of Minho (https://www.uminho.pt/PT)

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DRIVES

Development and Research on Innovative Vocational Education Skills

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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