

Title : Different types of Sensors

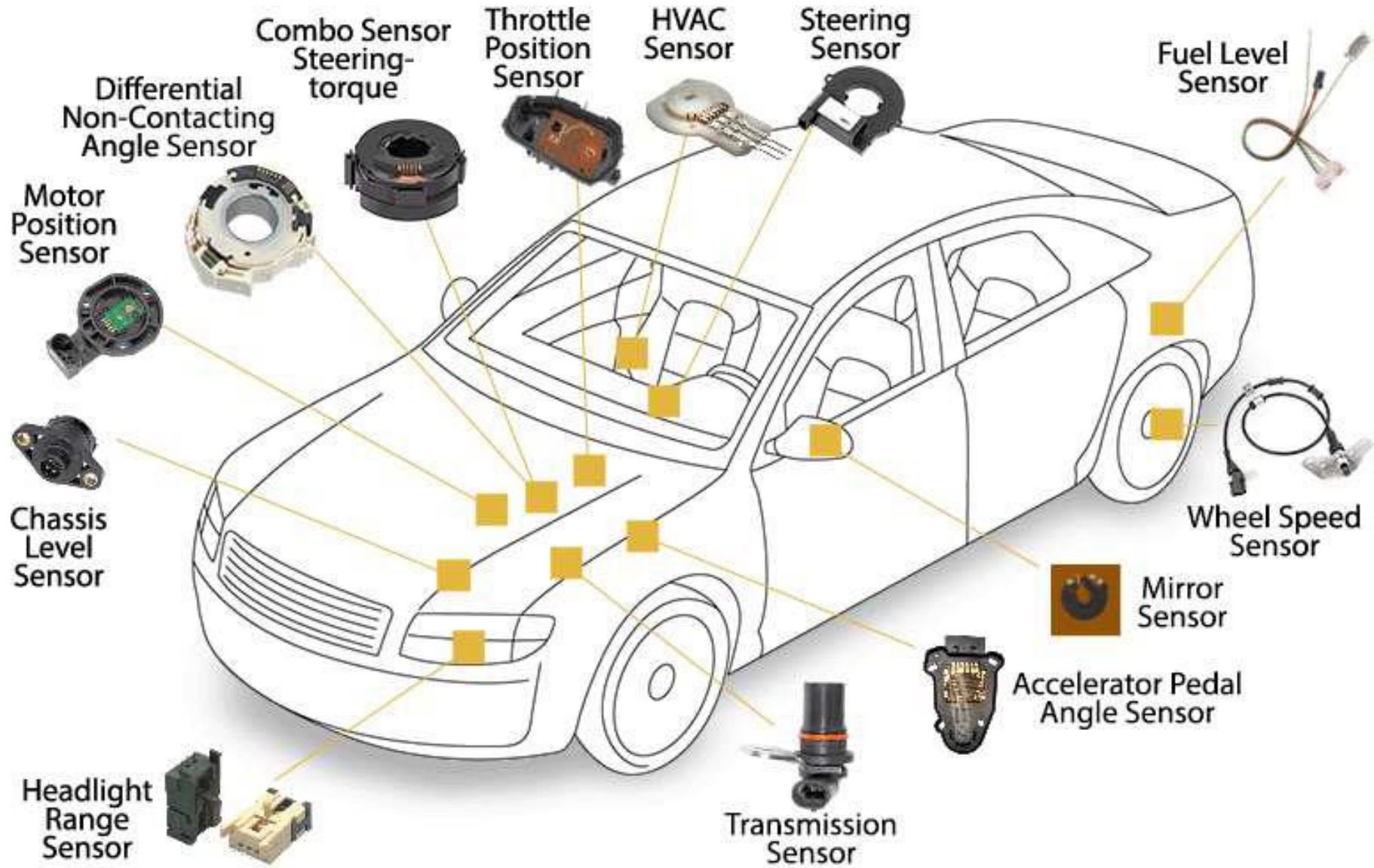
Date: 07/04/2020

Name of Faculty: Mr. Ankit P. Solanki

Lecture No : (04) 12:30 to 01:30

Source of Information : Industrial Automation & Robotics by Er. A. K. Gupta & S. K. Arora, University Science Press, Laxmi Publishing Pvt. Ltd.

Automotive Sensors

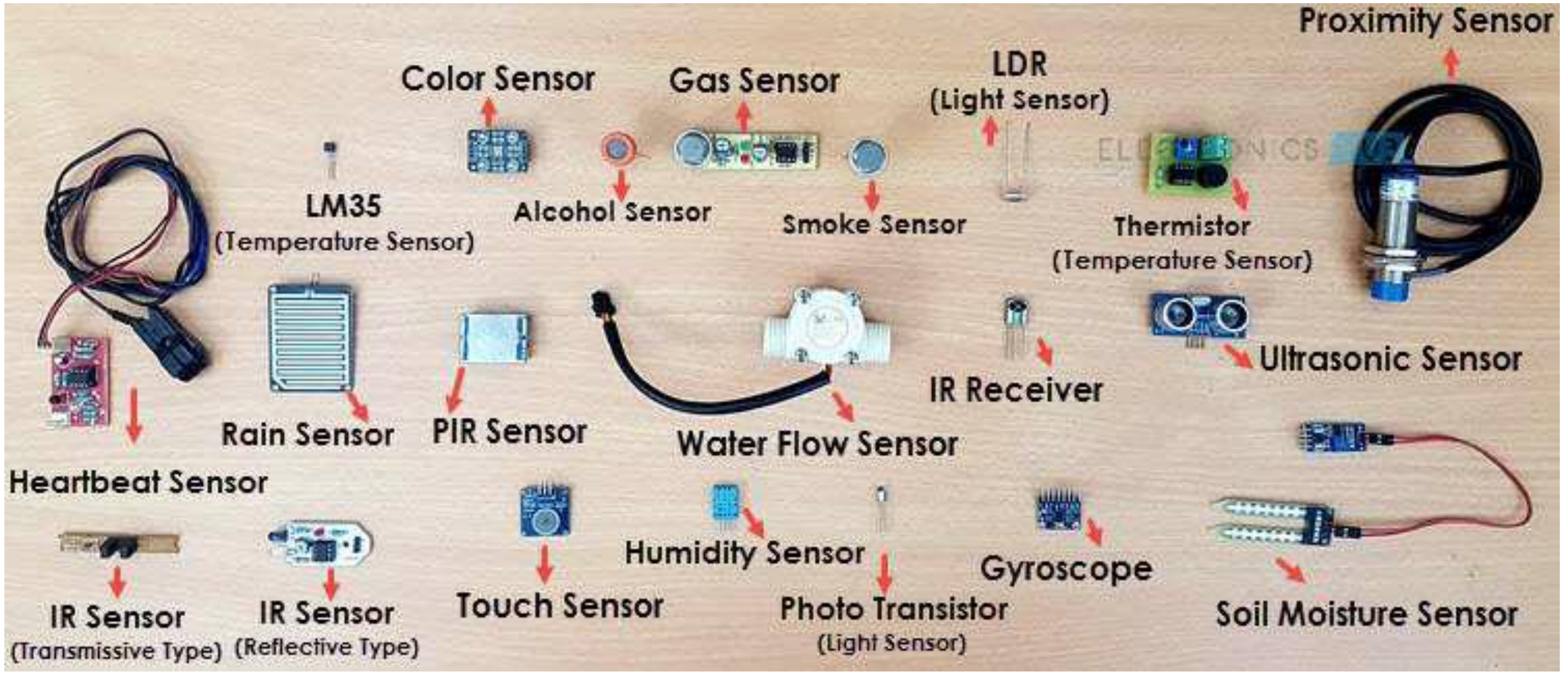


Sensors

- Sensor is an element which produces a signal relating to the quantity being measured.
- An input device which provides an output (signal) with respect to a specific physical quantity.
- A device that converts signals from one energy domain to electrical domain.



Different Sensors



Examples of Sensors

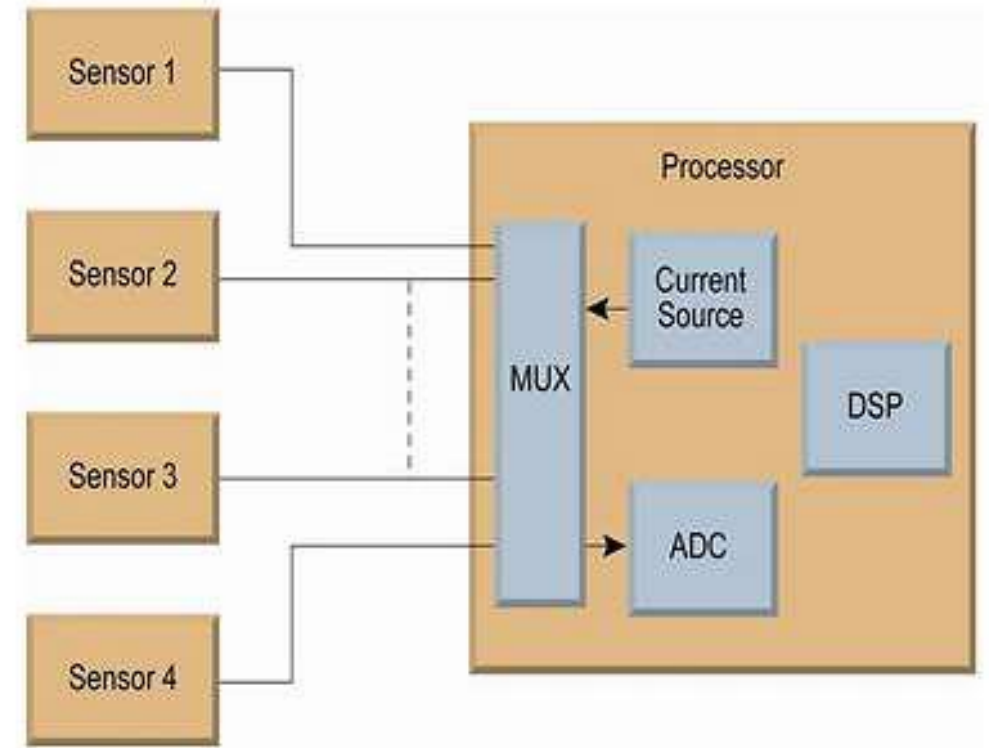
- **Dial Indicator:** the indicating spindle acts as a sensor/detector for displacement.
- **Bourdon Tube Pressure Gauge** is two fold: Firstly to sense the pressure & secondly to give the output in the form of displacement. Here the tube acts a sensor/detector transducer.
- **Compressive Load Cell:** the platform detects the force and gives an output in the form of deflection. This deflection may be further converted into an electrical output by strain gauges (called secondary transducer).

Smart Sensors

➤ Sensors that combined with signal conditioning and microprocessors are referred as smart sensors.

➤ Smart Sensors Applications

- ✓ Communications
- ✓ Computations
- ✓ Multi sensing
- ✓ Self calibration



Sensors

- The normal sensors have three crucial parts which are
 - 1) Sensing Element (Transistor, Capacitors, Photo Diode etc.).
 - 2) Conduction of Signals and Processing.
 - 3) Sensor Interface.

Criteria for Classification of Sensors

- 1) Primary Input Quantity (Measurand)
- 2) Transduction Principles (Using Physical and Chemical effects)
- 3) Material and Technology
- 4) Property
- 5) Application

Classification of Sensors

- **Active Sensor:** Active Sensors are those which require an external excitation signal or a power signal. E.g.: LiDAR (Light Detection and Ranging), Photoconductive Cell.
- **Passive Sensor:** Do not require any external power signal and directly generates output response. E.g.: Radiometers, film photography.
- **Based on Detection:** Some of the means of detection are Electric, Biological, Chemical, Radioactive etc.
- **Analogue Sensors:** Produce an analog output.
- **Digital Sensors:** Work with discrete or digital data.
- Some of the conversion phenomena are Photoelectric, Thermoelectric, Electrochemical, Electromagnetic, Thermo-optic, etc.

Classification of Sensors

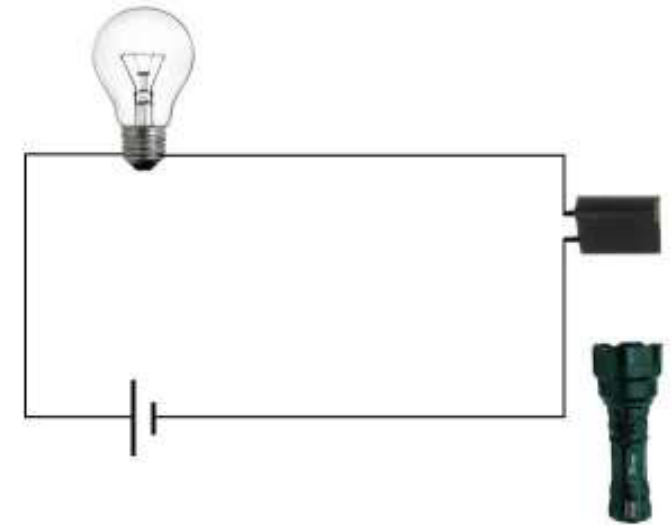
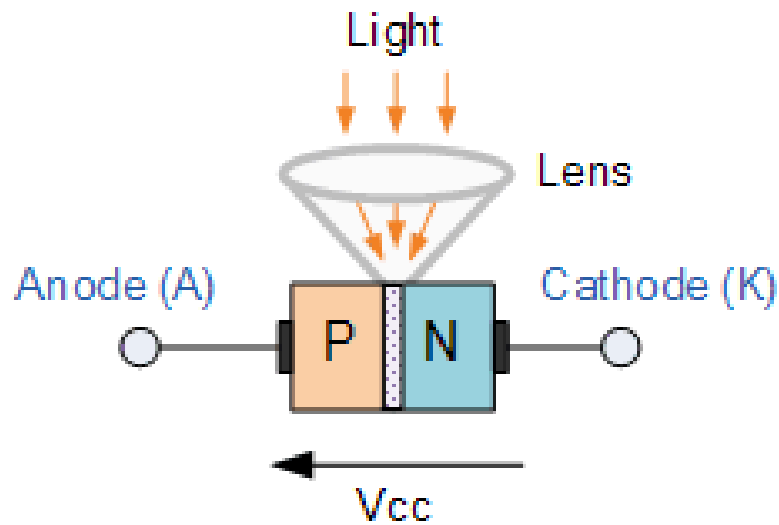
➤ All these sensors are used for measuring one of the physical properties like Temperature, Resistance, Capacitance, Conduction, Heat Transfer etc.

- 1) Temperature Sensor
- 2) Proximity Sensor
- 3) Accelerometer
- 4) IR Sensor
- 5) Pressure Sensor
- 6) Light Sensor
- 7) Ultrasonic Sensor

- 8) Smoke, Gas and Alcohol Sensor
- 9) Touch Sensor
- 10) Color Sensor
- 11) Humidity Sensor
- 12) Tilt Sensor
- 13) Flow and Level Sensor

Principle of working of Light sensors (Passive)

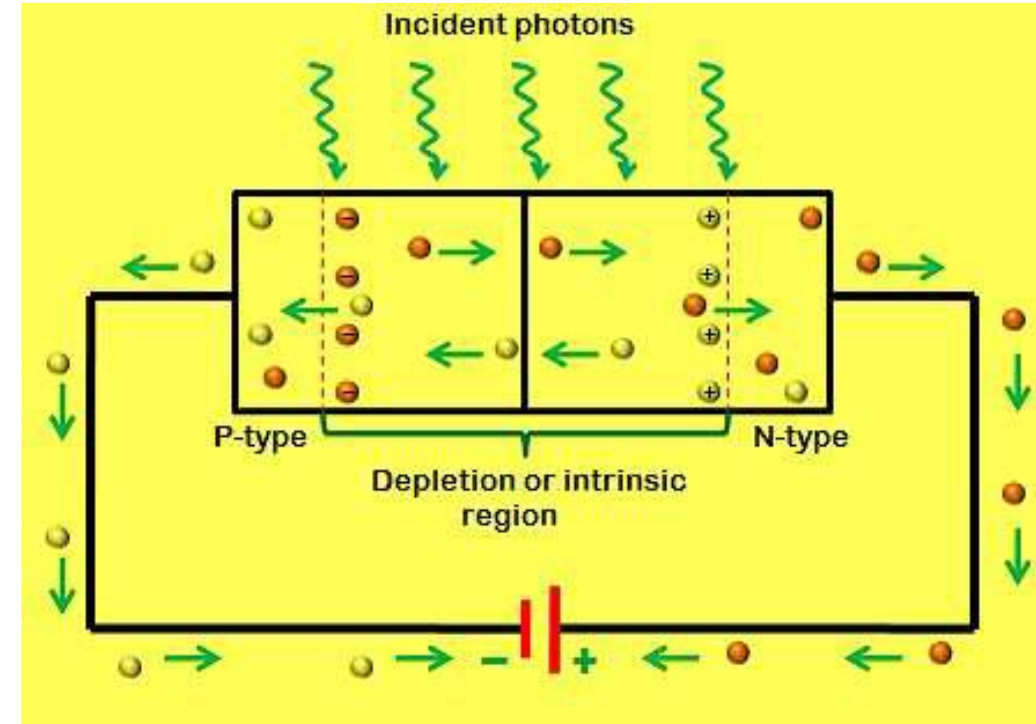
- Light Sensors are photoelectric devices / Photo sensors that convert light energy (photons) whether visible or infra-red light into an electrical signal.



Applications: Smoke detectors, compact disc players, and televisions, remote controls in VCRs, clock radios, street light

Principle of working of Light sensors (Passive)

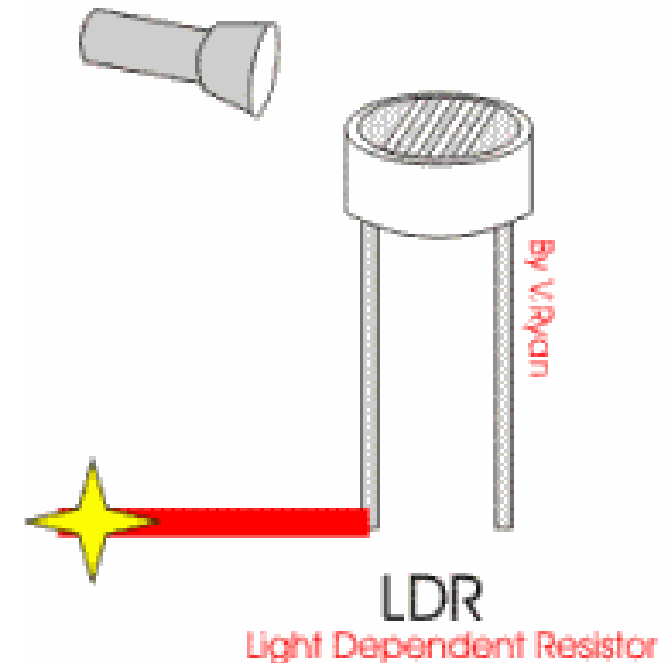
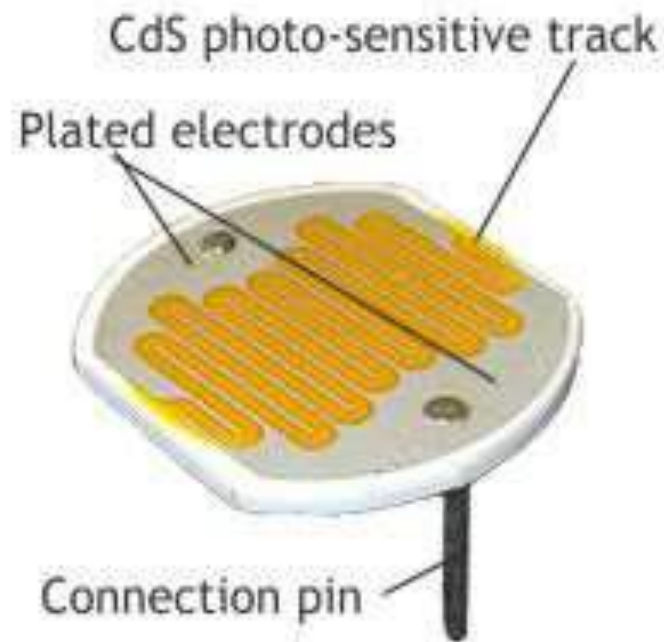
- **Photodiodes:** Are semiconductor junction, connected into a circuit in reverse bias giving a very high resistance.
- With no incident light, the reverse current is almost negligible and is termed the dark current.
- When light falls on the junction, extra hole–electron pairs are produced and there is an increase in the reverse current and the diode resistance drops.
- The reverse current is very nearly proportional to the intensity of the light.



Principle of working of Light sensors (Passive)

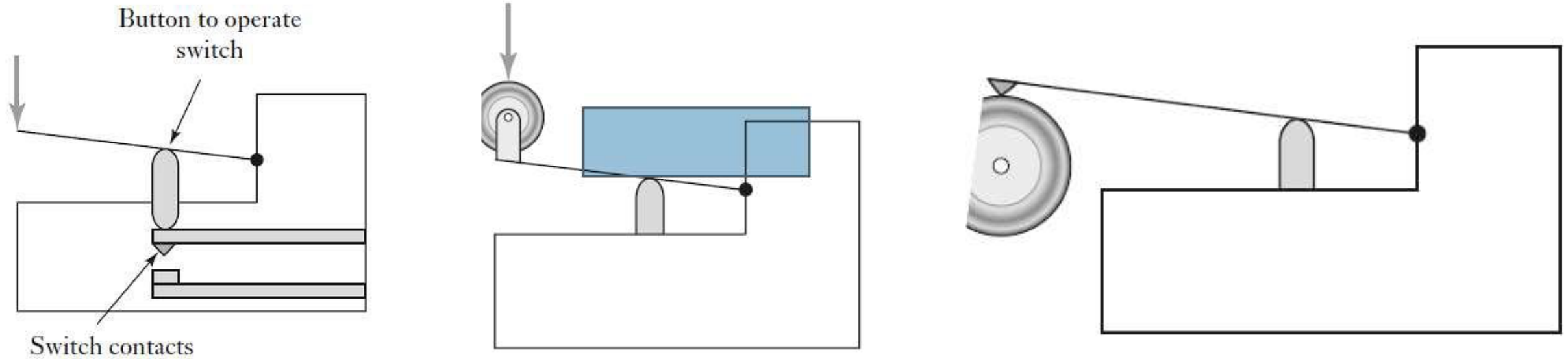
➤ **Photoresistor:** A photoresistor (or light-dependent resistor, LDR, or photoconductive cell) is a light-controlled variable resistor. The resistance of a photoresistor decreases with increasing incident light intensity (photoconductivity).

- a) Automatic Street Lights
- b) Light meters in camera
- c) Light sensors
- d) Clock radios



Principle of working of Proximity Switches

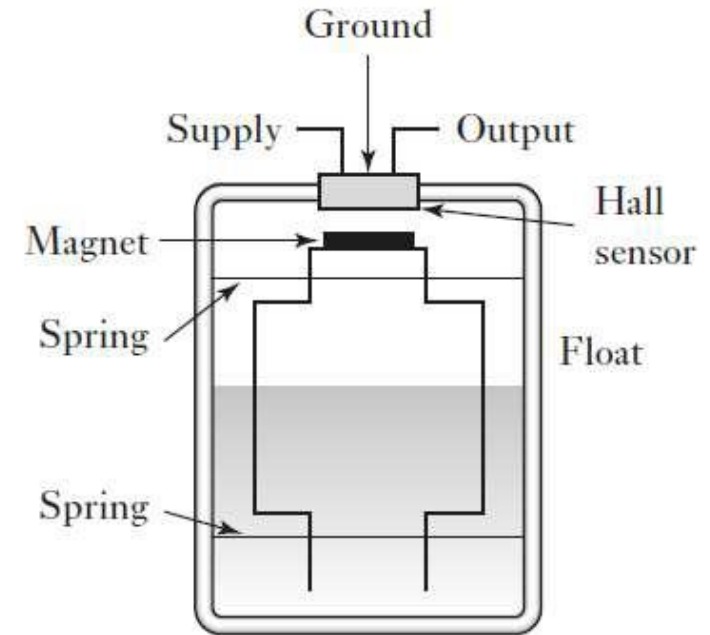
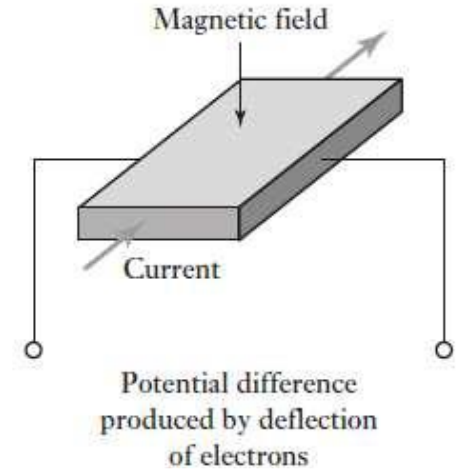
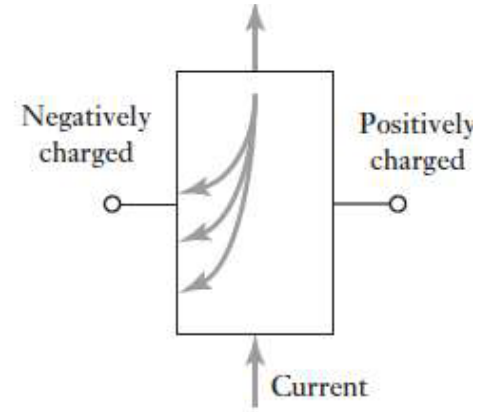
- A proximity sensor is a sensor able to detect the presence of nearby objects without any physical contact.
- The microswitch is a small electrical switch which requires physical contact and a small operating force to close the contacts.



(A) Lever-operated, (B) Roller-operated, (C) Cam-operated Switches

Hall Effect Sensors

- A Hall effect sensor is a device that is used to measure the magnitude of a magnetic field.
- Its output voltage is directly proportional to the magnetic field strength through it.
- Hall effect sensors are used for proximity sensing, positioning, speed detection, and current sensing applications.
- When a beam of charged particles passes through a magnetic field, forces act on the particles and the beam is deflected from its straight line path.



Assignment Questions

01	Write short note on Smart Sensors.	03
02	Broadly classify different of Sensors.	04
03	Write short note on Light sensors.	03
04	Write short note on Proximity Switches.	03
05	Write short note on Hall Effect Sensors.	03

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