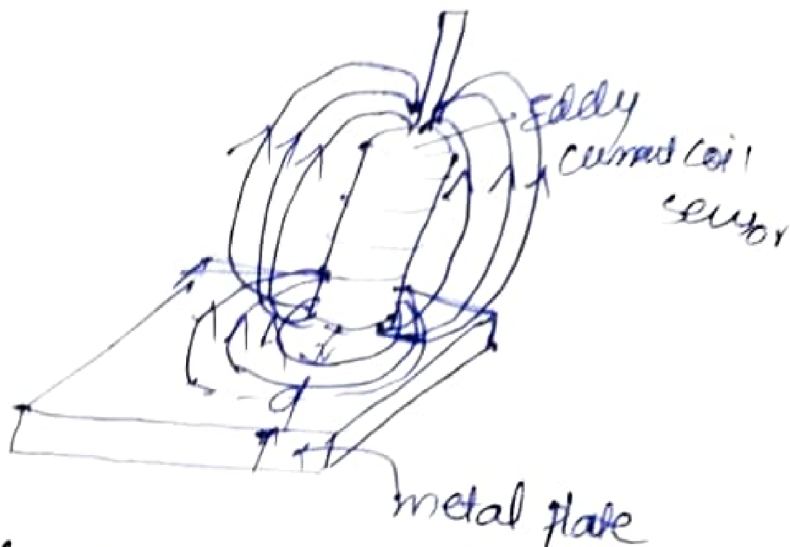
N ↑ emf ↑

Eddy Current Sensor:

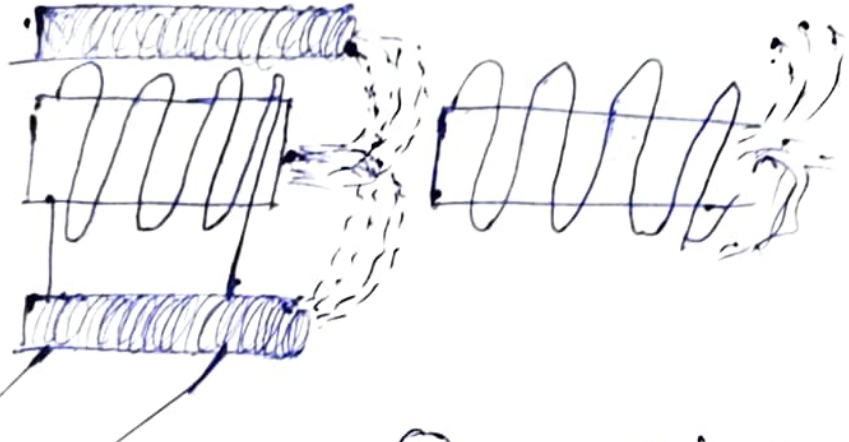


If a target (metal plate) is nearer to the magnetic field it will induce Eddycurrents in the plate & these currents consume power because of resistance and so the energy in the field is lost and there by decreases the signal amplitude. The detector examines this field magnitude to determine where it has decreased enough to switch. These sensors can detect object a few centimeters from the end.

Note:- When the object moves it causes a change in the impedance of the coil which is proportional to the distance between the sensor and the

target. These Sensors are used primarly for displa-cement & position management of electrically Conductive targets.

These are of 2 types



(a) shielded (b) non-shielded

ON-Board Automobile Sensors :-

Sensors for Automobiles, that is, automotive on-board sensors come with some special constraints and feature that include environment, reliability, cost, and resources and innovations.

→ Engine is the heart of the automobile which is exposed to vibration, dust, electrical, noise, extreme temperature variations, → one such sensor is the automobile has a temperature varying from -40 to 150°C and vibrational acceleration ranging from 3g-30g.

→ Exposure to water, oil, ~~mud~~, electromagnetic interference, and the like are also to be taken into consideration for better performance.

→ In present day mobile automobile systems, sensing is required to be done majorly for

(i) engine control
(ii) manouvering control
(iii) room and operational comfort control.
(iv) Safety and reliability. and
(v) fuel consumption control.

X-Ray and Nuclear Radiation sensors:

These are high energy radiations compared to optical range of radiations, and have different units of measurements for their energy content at different parameters. For example Roentgen is a measure of intensity of the radiation in air, and is defined as the charge, per cc of air at 0°c at 1 atm pressure.

Radiation damage that occurs due to x-Rays, γ-rays is called relative biological effectness (RBE) and it is denoted by R.

Types of x-ray and nuclear radiation sensors are

i) Geiger-Muller counter
ii) Proportional counter
iii) Scintillation counter
iv) Ionization chamber
v) Election multiplier tubes
vi) Non-dispersive detectors.

The nuclear emissions from radioisotopes are

i) α-particles
ii) β-particles
iii) γ-rays.

These are ionizing radiations and neutrons and x-Rays are ionizing radiation but not nuclear in nature.

The non-ionizing radiations comprise of

i) UV-visible-IR optical types
ii) Extremely low frequency, radio-frequency, microwave

Ionizing Radiation	characteristics	Detectors
α-particles (He^{++})	Positively charge, highly ionizing, low penetration discrete energy levels.	Ionization chamber, proportional counter, scintillation counter semiconductors, plastic films
β-particles (e^-, e^+)	electrons and positrons, more penetration than α and continuous energy	Geiger-Muller counter, plastic films, proportional counter, scintillation counter
γ-rays & x-rays	Penetrating electromagnetic types	Geiger-Muller (x-rays), photon-spectrometer, proportional counter
Neutrons (n)	Indirectly ionizing	p-n junction diode, etched track films,

⑤ An intelligent sensor is able to self-test, self-validate, self-adapt as well as self-identify. These sensors understand the environment they are put into and they can manage a wide range of conditions

- An intelligent sensor is capable of managing its functions as a result of stimulus from external functions.

- This shows that an intelligent sensor has the architecture of advanced learning, adaption and signal processing, all in one integrated circuit.

→ Examples (to be explained):

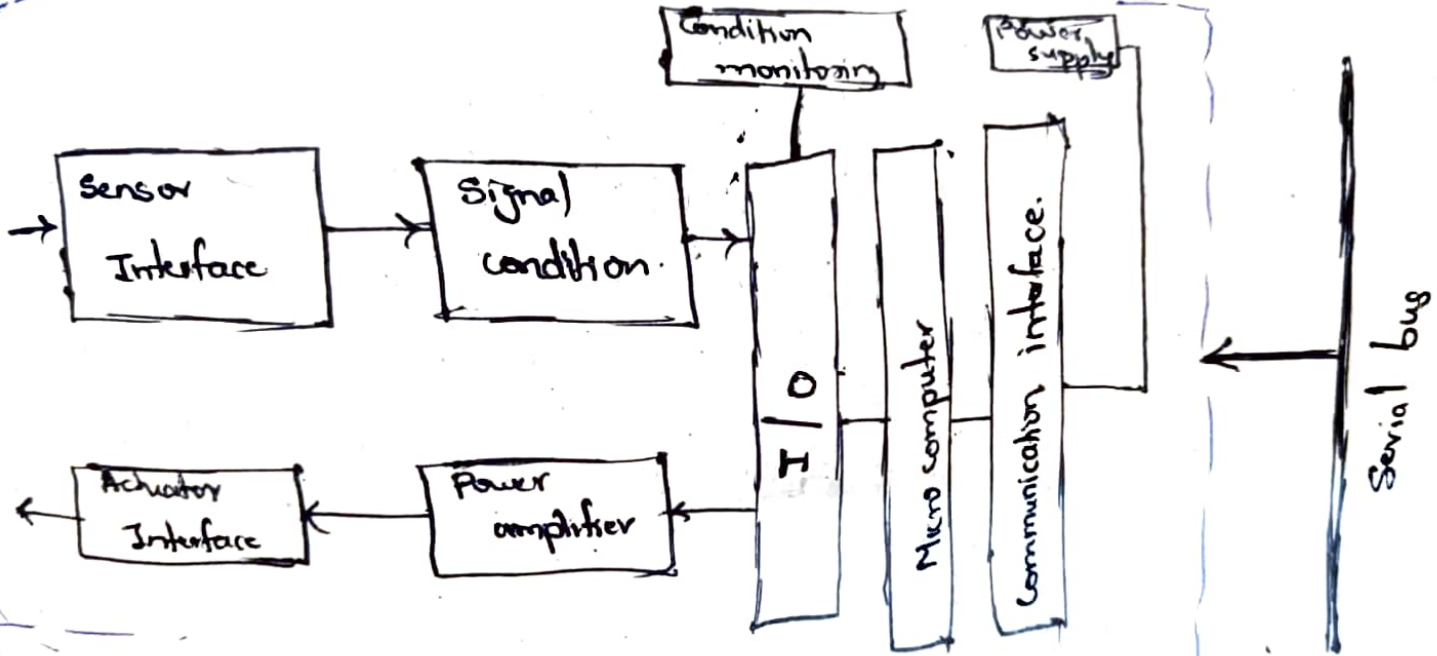
(i) Environment monitoring

(ii) Smart health monitoring

(iii) Smart agriculture

explain any two as how intelligent sensors are needed here

systems is as shown below:

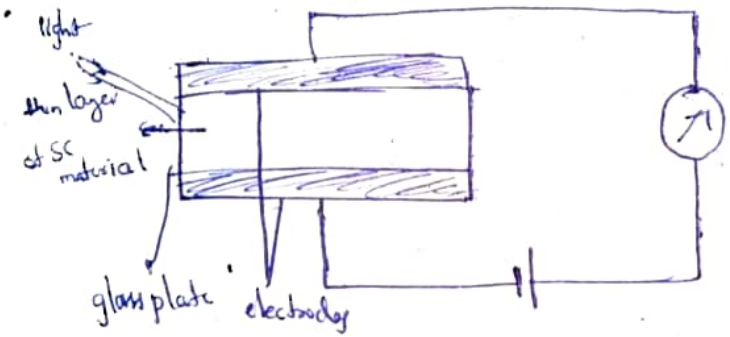


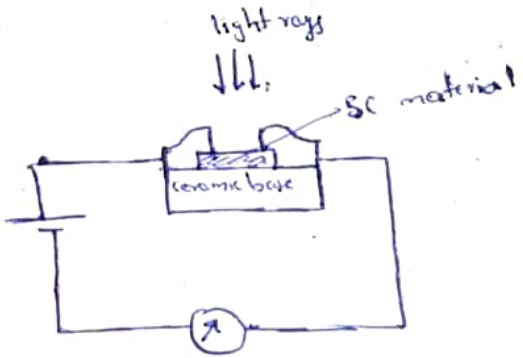
DSP: digital Signal processing

3) Photoresistors / LDR

→ The photoconductive cells, also known as photoresistors, contain a thin film of certain semiconductor materials deposited over a ceramic

→ When these semiconductor materials are exposed to light, their electrical conductivity is increased





→ Typically the film is made of lead or calcium sulfide, or telluride.

→ The materials used to make the films in photoconductive cells are generally poor electrical-current conductors because their e^{s} are unable to move freely within the material when an electrical voltage is applied.

→ Light directed on such materials is absorbed by some $\bar{e}^s$, however freeing them to pass more easily from one atom to the next.

→ When photo conductive materials are removed from the light, the $\bar{e}^s$ return to their more tightly bound state.

Materials used in the cells are:

(a) Cadmium Selenide

(b) Lead Sulphide

(c) Doped Germanium.

materials used in photo resistors

Applications:

→ used in alarms, door openers.

→ digital tachometers

→ production line counters.

→ scanner for UPC