* Temperature Sensor :

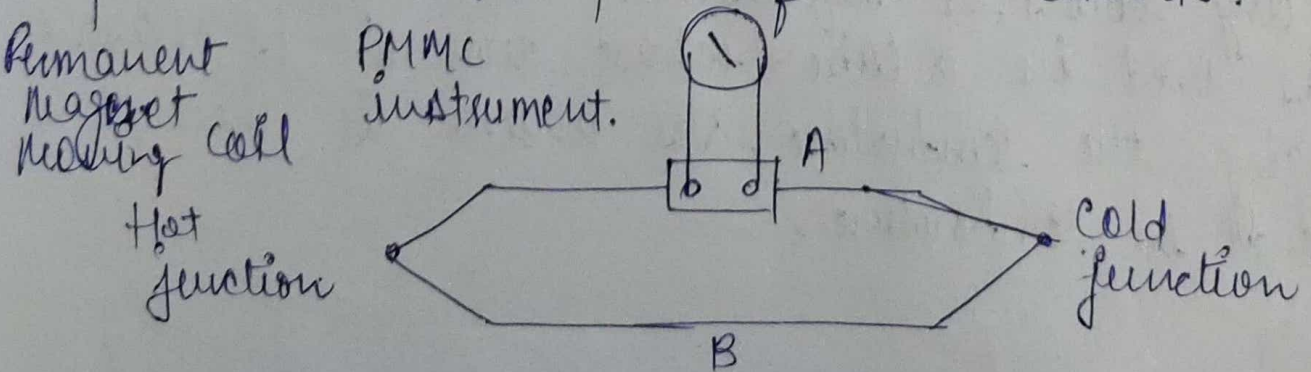
It is a device used to measure the temperature through an electrical signal. It requires a thermocouple or RTD (Resistance temperature Detector).

Working → The measurement of the temperature sensor is about the hotness or coolness of an object. The working base of the sensors is the voltage that read across the diode. If the voltage increases, then the temperature rises and there is a voltage drop between the transistor terminals of base & emitter they are recorded by the sensors.

If the difference in voltage is amplified, the analogue signal is generated by the device and it is directly proportional to the temperature.

Types of Temperature sensor :

1. Thermocouple Sensor → A thermocouple is a temperature measuring device consisting of two dissimilar conductors that contact each other at one or more points. It produces a voltage when the temperature of one of the points differs from the reference temperature at other parts of the circuits.



2. Thermistor Sensor → this type of sensors is used mostly in the human thermometers. If there is a change in the temperature, then the electrical current or resistance also changes. The thermistor is prepared by using the semiconductor materials with a resistivity which is specially sensitive to temp. The resistance of a thermistor decreases with increasing temperature, so that when the temp. changes the resistance change is predictable.

★ RTD (Resistance Temperature Detector):

These are the temp. sensors with a resistor that changes the resistive value simultaneously with temperature changes. The RTD are used in a wide temp. range from -500C to 5000C for thin film & for the wire wound variety the range is from the +2000C to 8500C. The thin layer of platinum on a substrate is present on the thin film RTD element. A new pattern is created which provide the electrical ckt and its trimmed to give a specific resistance.

★ Thermometer:

It is a device which is used to measure the temperature of any solids, or liquids. In this type alcohol is used in a tube whose volume is changed by changing the temprature. Its volume is directly proportional to temperature.

3. IR (Infrared) Temperature Sensor → these are an electronic & non-contacting sensor which have a certain characteristics such that it can detect (emits) the IR radiations. Two types of IR Ts used in market are IRs and quantum IRs. It detects the surface temperature by emitting radiations. Thus its cost depends on its working capabilities means its accuracy level depends upon its cost in other words low cost low accuracy level and high cost - high accuracy level.

4. Semiconductor based sensor → IC's T.S.

It operate with reverse bias; have a small capacitance and a low leakage current. They are formed on thin wafers of silicon. They are compact, produce linear outputs, and have a small range of temperature. They also have low cost and are accurate following calibration.

Types →
1. Voltage output.
2. current output
3. Digital output
4. Resistance output
5. Simple diodes

* Humidity Sensor: (hygrometer)

It senses, measures and reports both moisture and air temperature. The ratio of moisture in the air to the highest amount of that a particular air temperature is called relative humidity.

It works by detecting changes that alter electrical currents or temperature in the air.

Types →
- capacitive
- Resistive
- Thermal

- **Capacitive** → It measures relative humidity by placing a thin strip of metal oxide between the electrodes. The metal oxide's electrical capacity changes with the atmosphere's relative humidity. Weather, commercial and industrial are the major application areas.

- **Resistive** → It utilize ions in salts to measure the electrical impedance of atoms. As humidity changes, so do the resistance of the electrodes on either side of the salt medium.

- **Thermal** → Two thermal sensors conduct electricity based upon the humidity of the surrounding air. One sensor is encased in dry nitrogen, while the other measures ambient air. The difference between the two measures the humidity.

Working:

→ It usually contain a humidity sensing element along with the thermister to measure temp. (types)

Applications:

→ It is used for various applications for measuring humidity in HVAC systems, printers, fan machines, weather stations, automobiles, food processing, refrigerators etc.

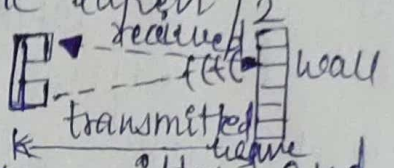
→ Due to their low cost and small size, resistive sensors are used in residential, industrial and domestic applications. Thermal conductors are commonly used in pharmaceutical plants, food hydration, drying machines etc.

★ Ultrasonic sensor:

respective object by sending the wave of

An ultrasonic sensor is measures the distance of a specific frequency. This sound wave is reflected after the collision with respective object and this wave is received by the ultrasonic receiver. Distance is measured by calculating sending and receiving time of this sound wave.

Distance = Sound speed × time taken / 2



Working:

It consists of set of ultrasonic transmitter and receiver which are operated at same frequency. When anything or object comes into the area of covered circuit then its frequency sound reflected so receiver and alarm is triggered. This sensor ckt is very sensitive and it could be reset automatically or still in triggered until it is reset manually

Types:

- **Ultrasonic Proximity Sensors** → A special type of sonic transducer is used in this sensors. for alternate transmission and reception of sound wave. This sonic transducer emits the sonic waves which are reflected by an object and after this emission this sensors switched in to receive mode.
- **Ultrasonic 2 Point Proximity Sensors** → It consists of 2 points for switching, therefore is is called a point proximity switches. It is almost similar with standard sensors only differ the a touch set up key and this function is called teach-in function. Its

switches sdel1 s sda2 could be easily programmed within the help of built in tech. In button.

- **Ultrasonic Retro reflective sensors** → The operation of ultrasonic retro reflective sensor is similar with ultrasonic proximity sensors. Only difference, in this sensor the distance b/w sensor to reflector is measured by measuring the propagation object could be used as a reflector and sensing distance (sd) could be adjust by adjusting the potentiometer resistance with in ultrasonic sensors.

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