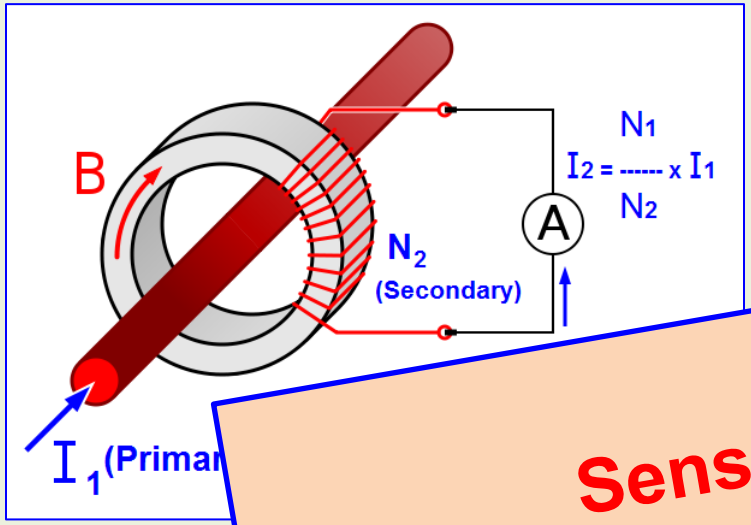
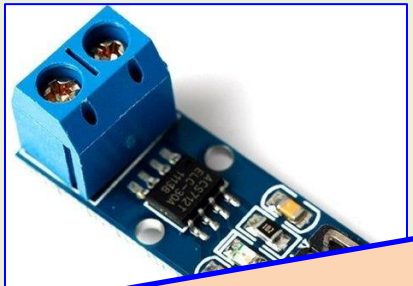
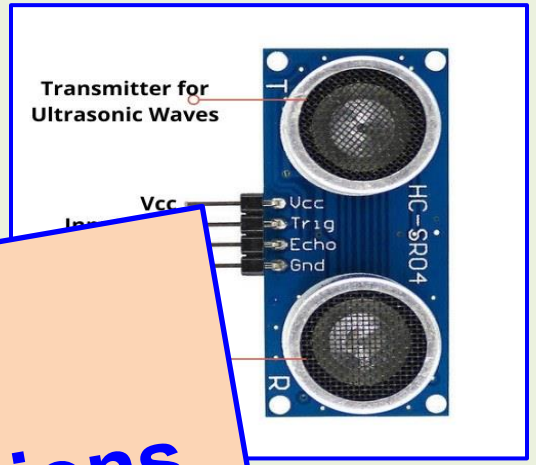
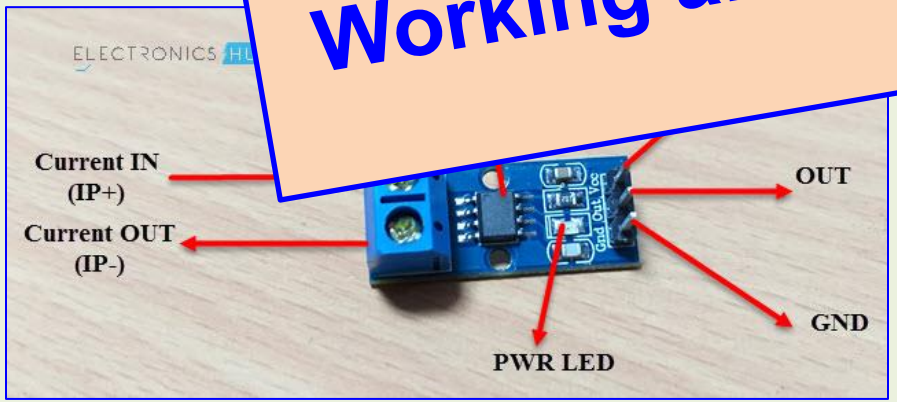
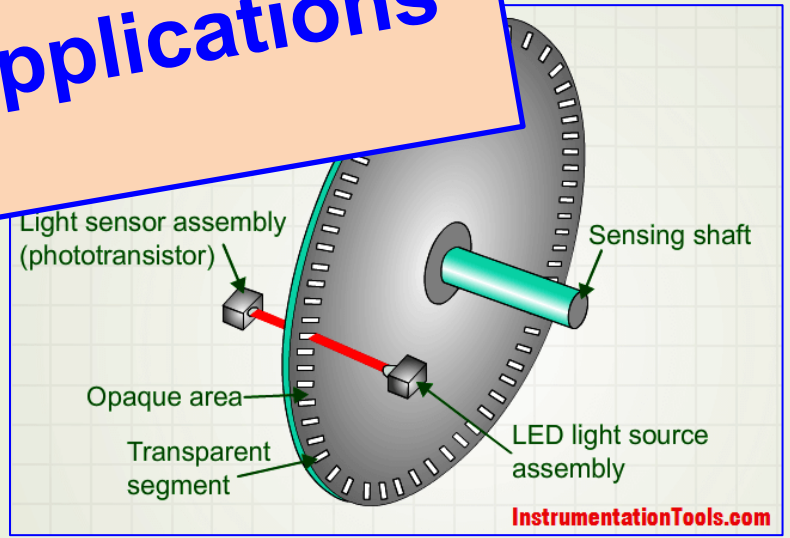






Sensors – 1.2
Working and Applications

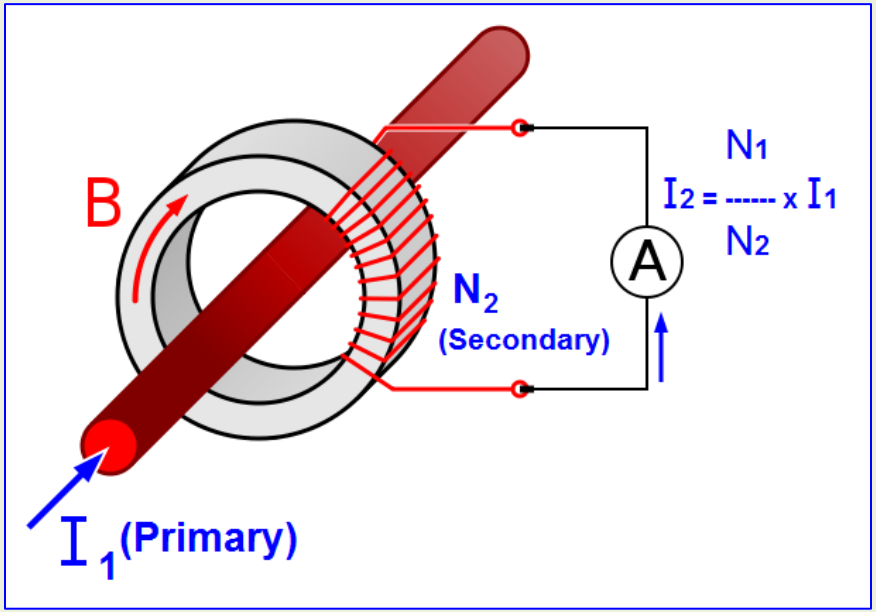




Different types of Sensors : Based on working principle and parameter to be measured

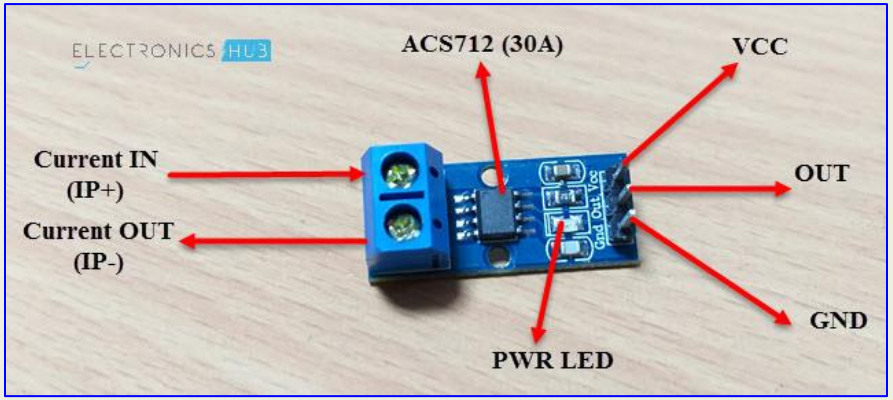
- Proximity sensor (Range sensor)
- Tactile sensor (Contact sensor)
- Current sensor
- Tilt sensors (Angle sensor)
- Gyroscope (Angular velocity)
- Encoders (Speed sensor)
- Hall effect sensors (Magnetism sensor)
- Temperature sensor
- Acceleration sensor
- Image sensor

Current sensor : Electromagnetic induction

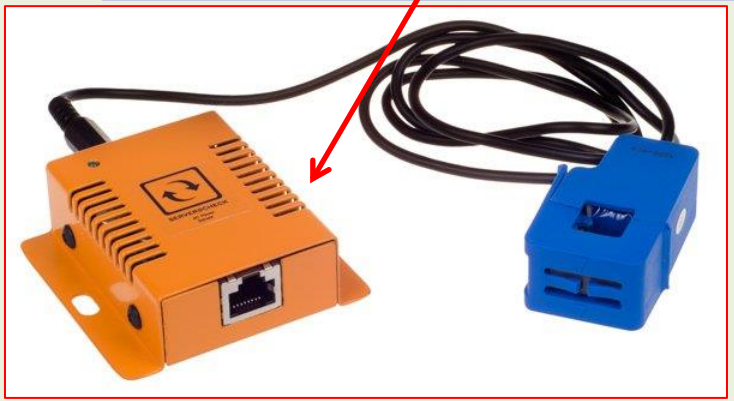


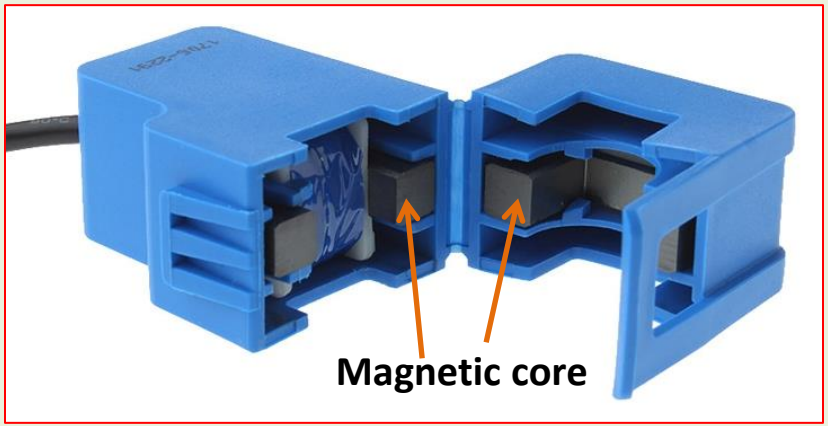
- An EMF is induced in the secondary coil of the sensor based on Electromagnetic induction.
- EMF α current in the primary.
- Correct number of turns in the secondary is the crucial parameter.
- Current can be calculated from measurement of the generated EMF.

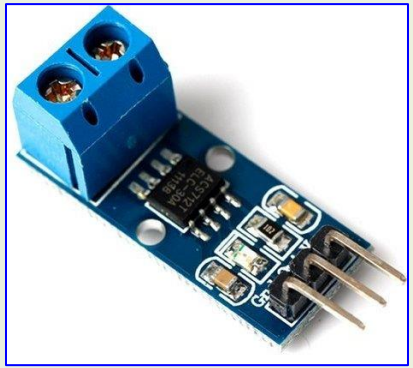
Pin out of a typical current sensor

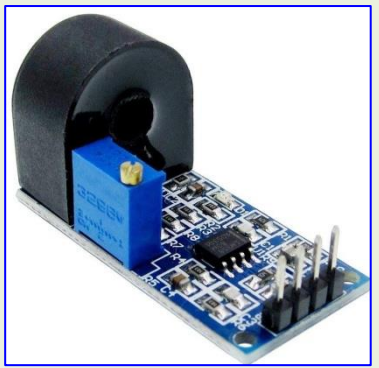


CT with analog current to digital current conversion unit

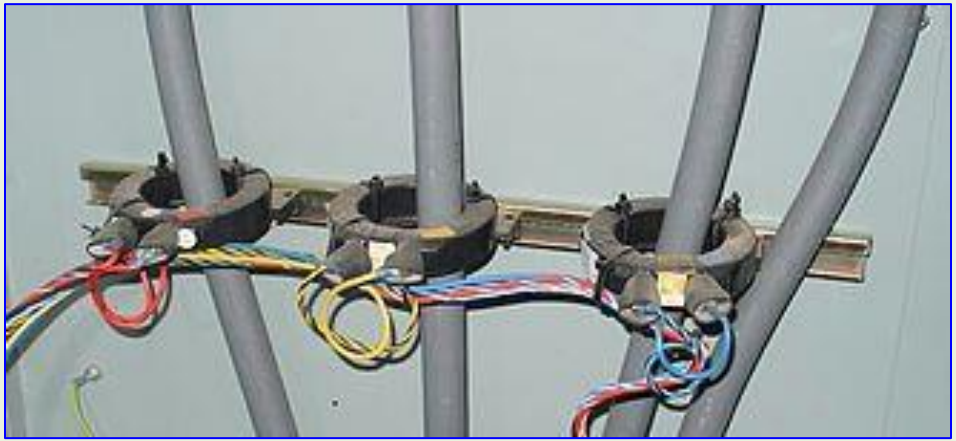


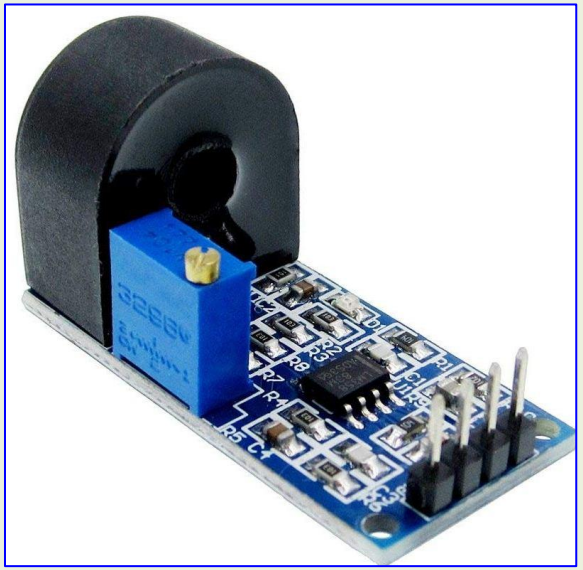






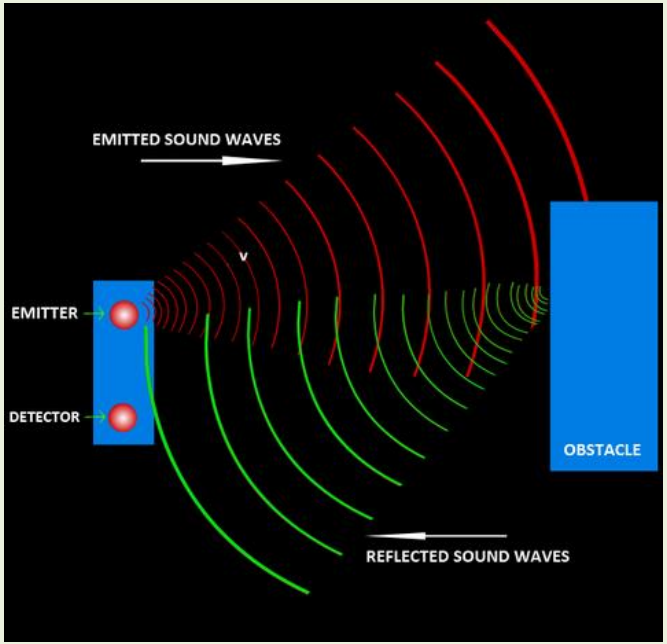
Current sensors used in a 3 phase system





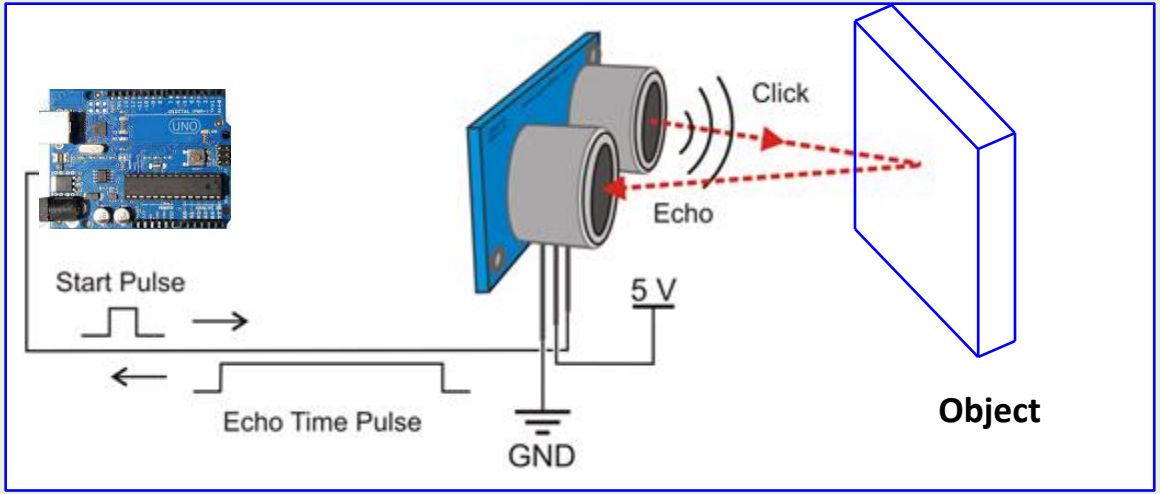
Ultrasonic sensor :

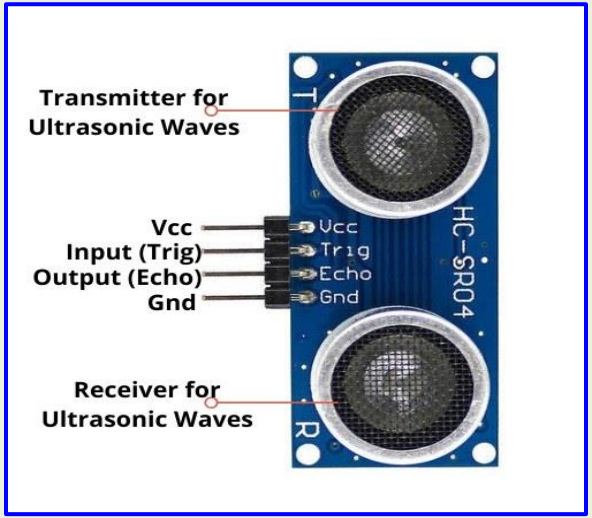
- Sound waves move at a speed of 343 m/sec. (approx)
- Human beings can hear sound waves between a range of 20 Hz to 20 KHz.
- Below 20 Hz is called as Infrasonic sound.
- Above 20,000 Hz is called as Ultrasonic sound.
- Ultrasonic sensor uses ultrasonic sound waves to measure distance between two objects.
- A transmitter emits sound waves and a receiver collects them back when reflected from the object.
- The time taken for the two way travel is measured and the distance is calculated.



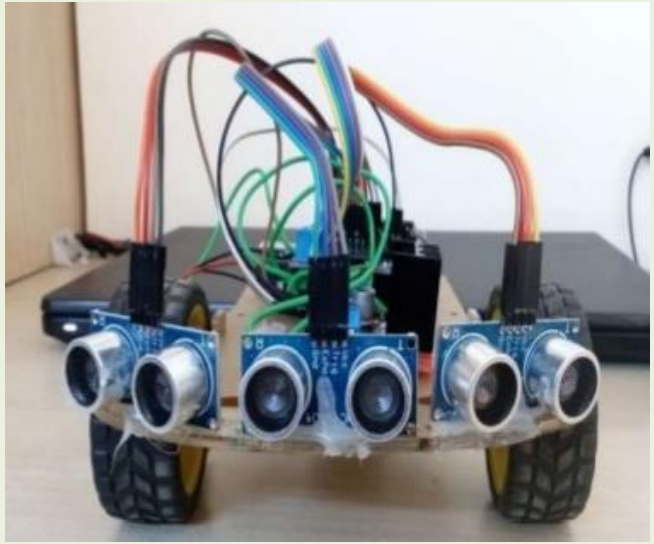
$$D = \frac{\text{(time taken x speed of waves)}}{2}$$

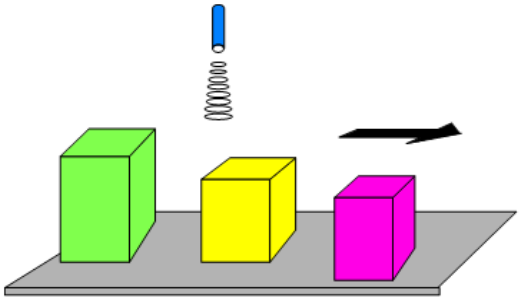
Ultrasonic sensor :



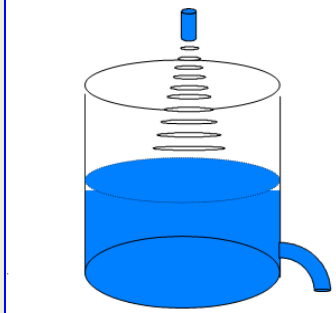


Ultrasonic sensor :



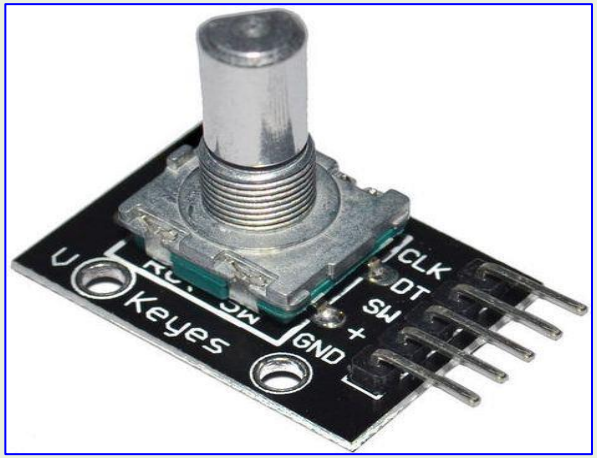


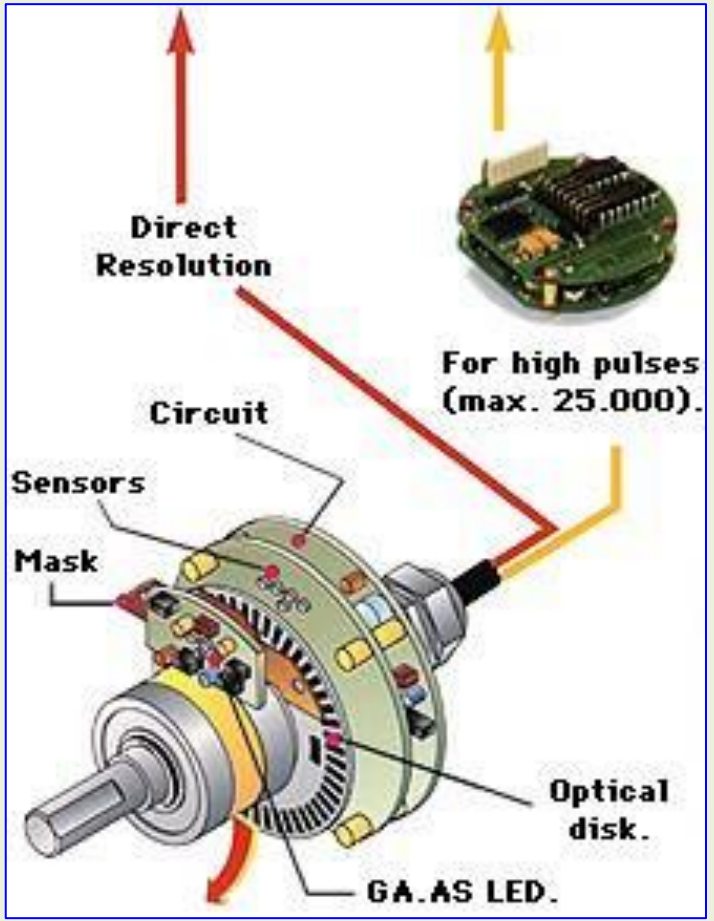
Object Detection



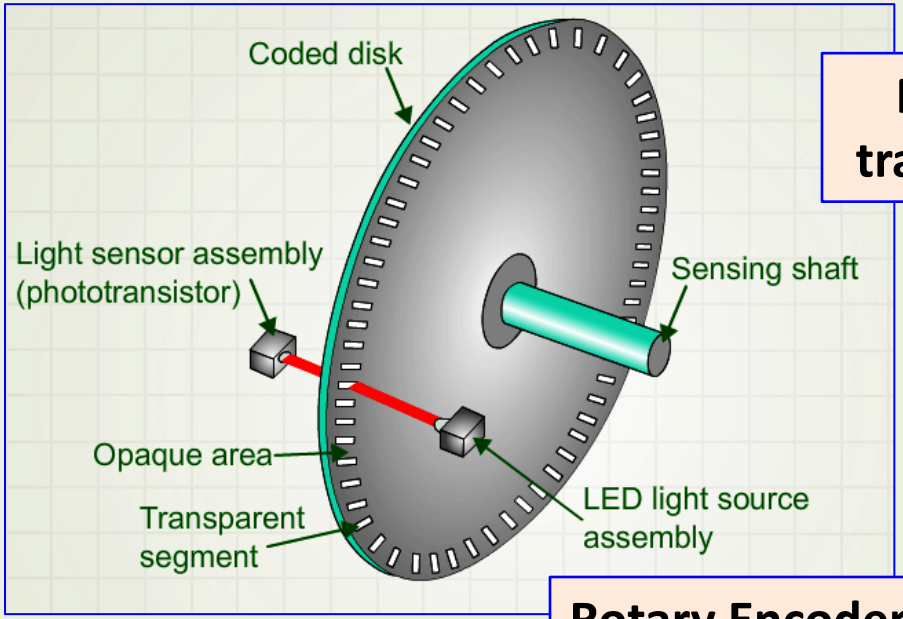
Liquid level control

Rotary Encoder : Sensor for measurement of Speed of Motors :

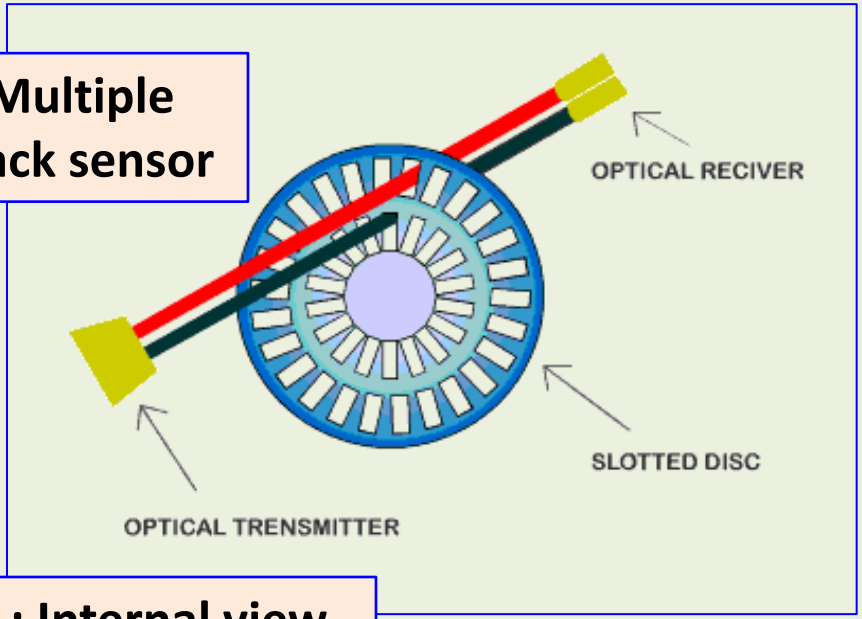




Rotary Encoder : Sensor for measurement of Speed of Motors :

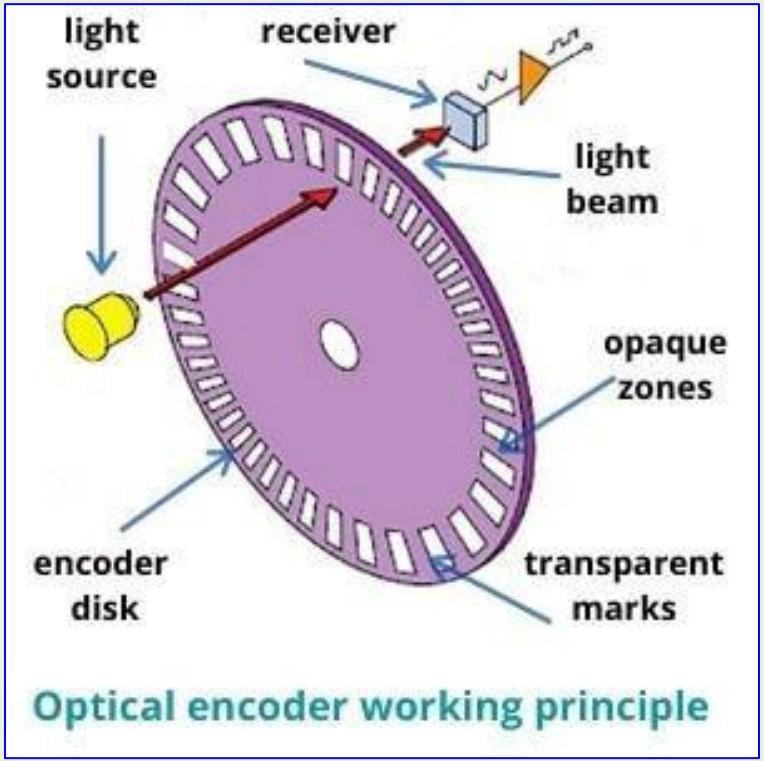


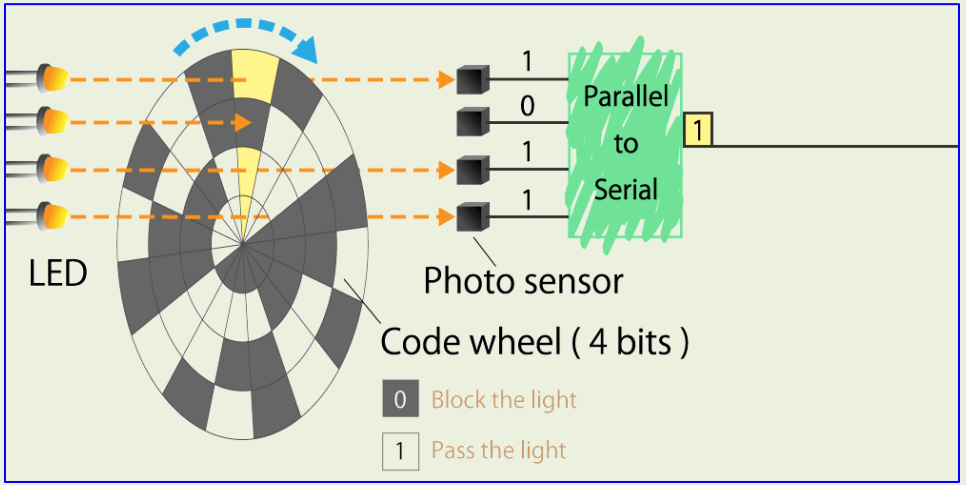
Multiple track sensor



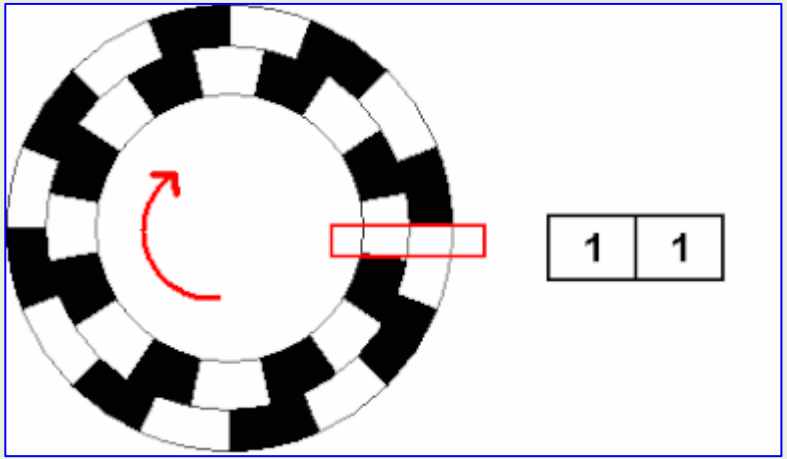
Rotary Encoder : Internal view

Rotary Encoder :



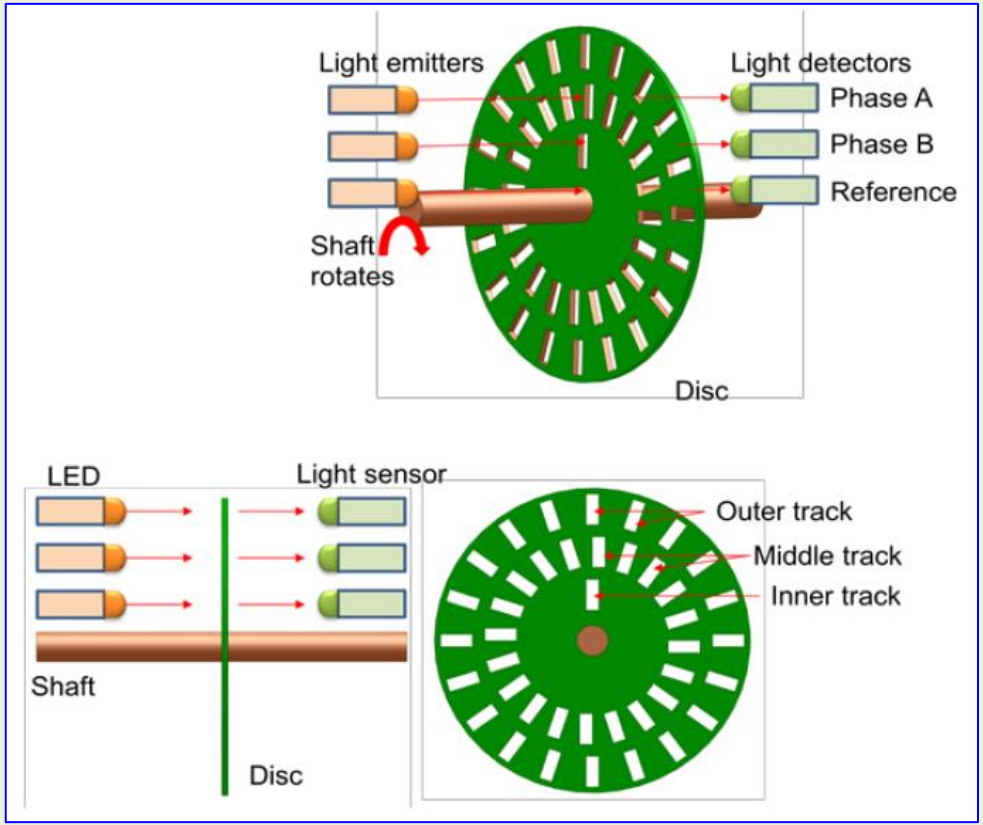


Rotary Encoder :

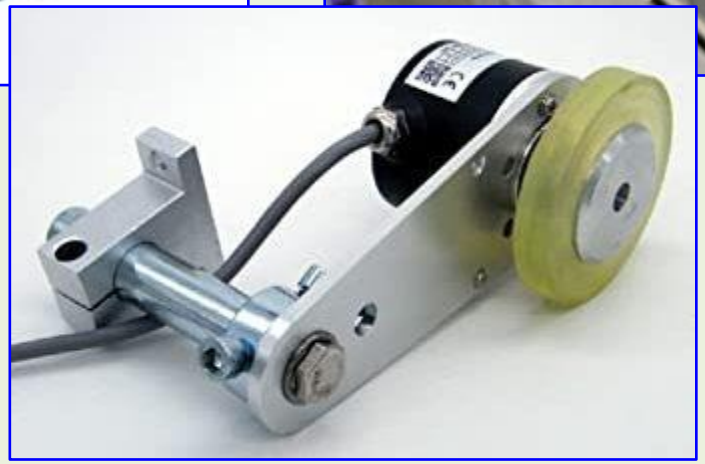


Rotary Encoder : Multiple track encoder

Multiple tracks give more resolution and accuracy



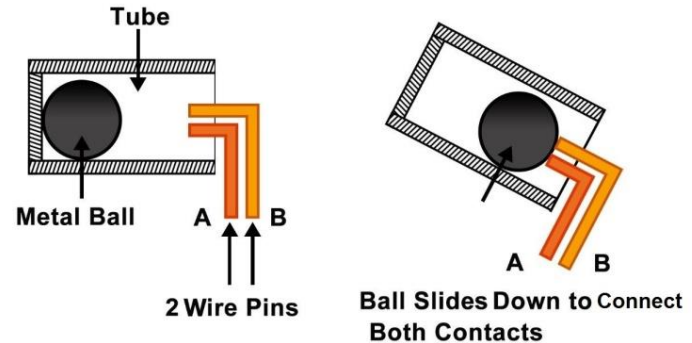
Rotary Encoder : Industrial applications



Tilt sensor : for sensing the angle of tilt or inclination.

- This sensor produces an electrical signal which is proportional to the angle of tilt / inclination w.r.t. some axis or multiple axes.

- Type 1) Digital : Output of this sensor is whether the object is either vertical (or horizontal) or not. Single ball / Double ball / Mercury is used.

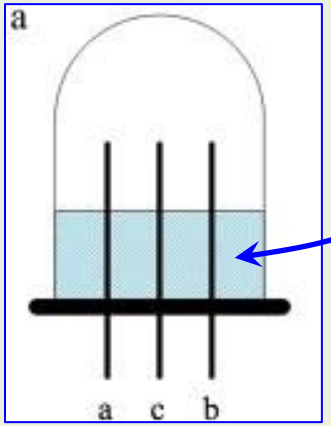


Tilt sensor : for sensing the angle of tilt or inclination.

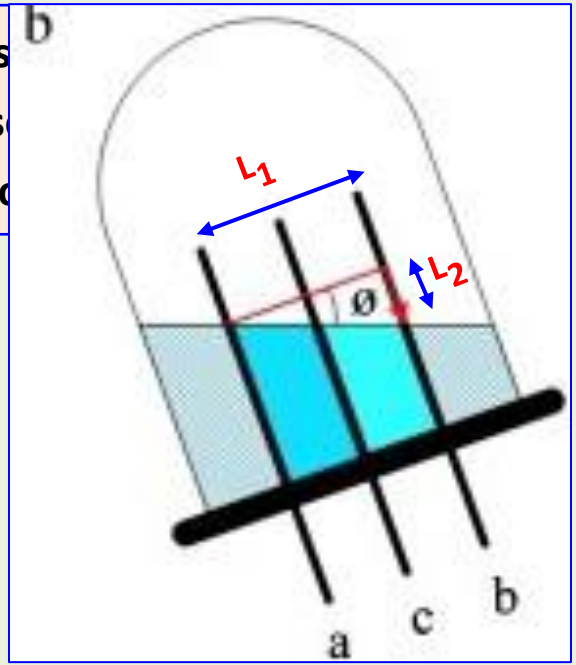
➧ **Type 2) Analog : This sens**

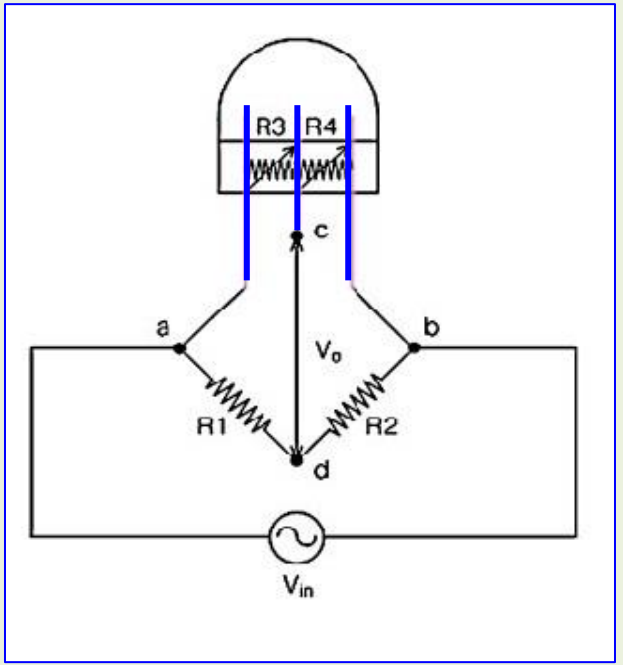
actually made by the sens

based sensor using an electr



Conducting Electrolyte





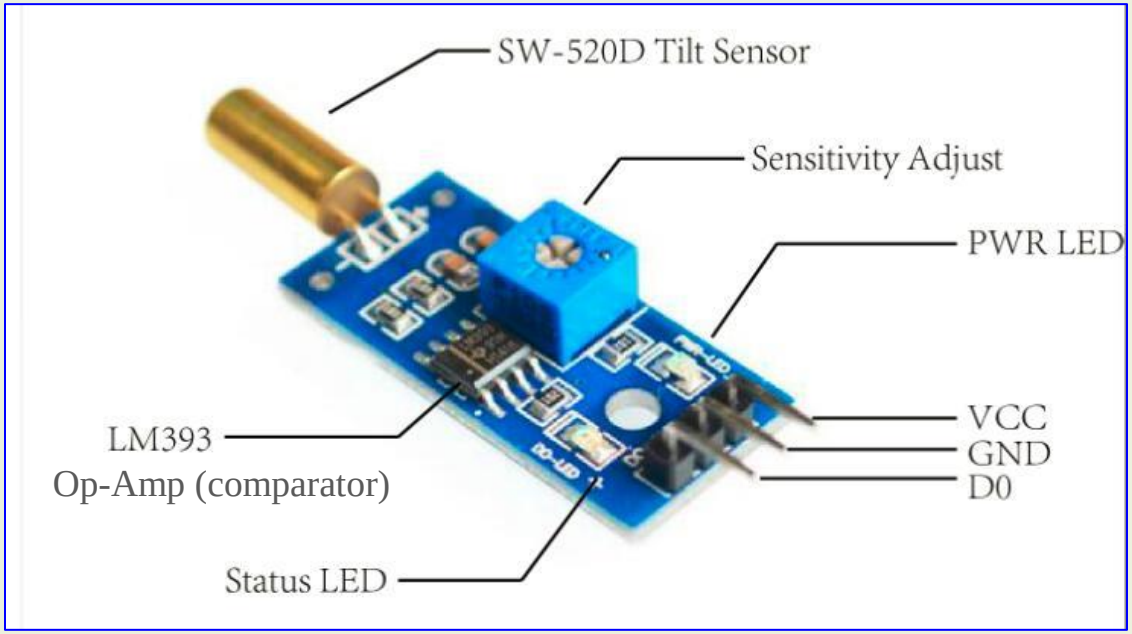
$\tan \theta = L_2 / L_1$

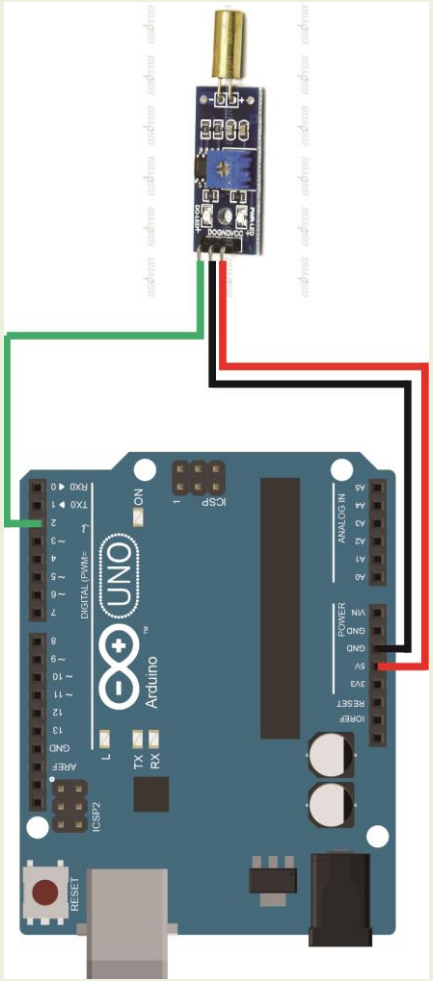
L_1 is a constant whereas L_2 is variable.

$L_2 \alpha \tan \theta$

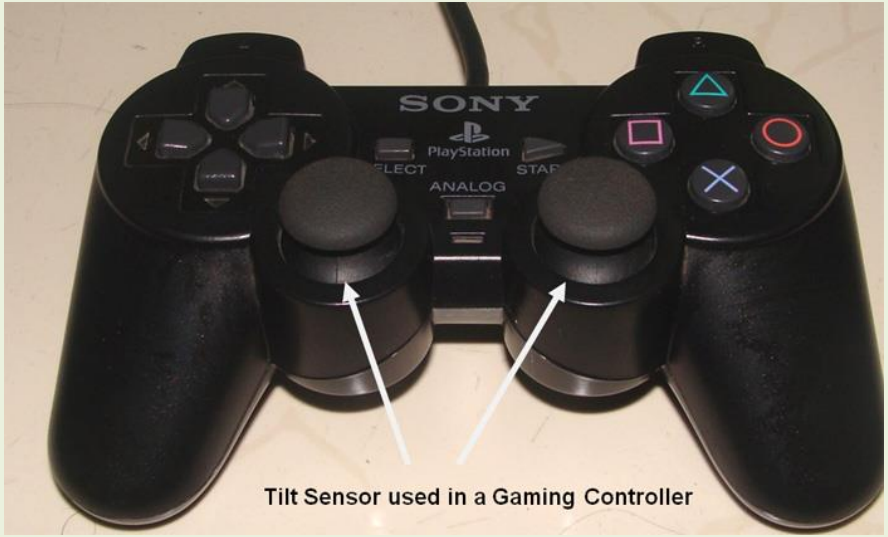
When the sensor is inclined, the proportion between R1, R2, R3 and R4 is disturbed. Measuring the R3 and R4, angle θ is calculated.

Tilt sensor : Pin out Interfacing with Arduino UNO

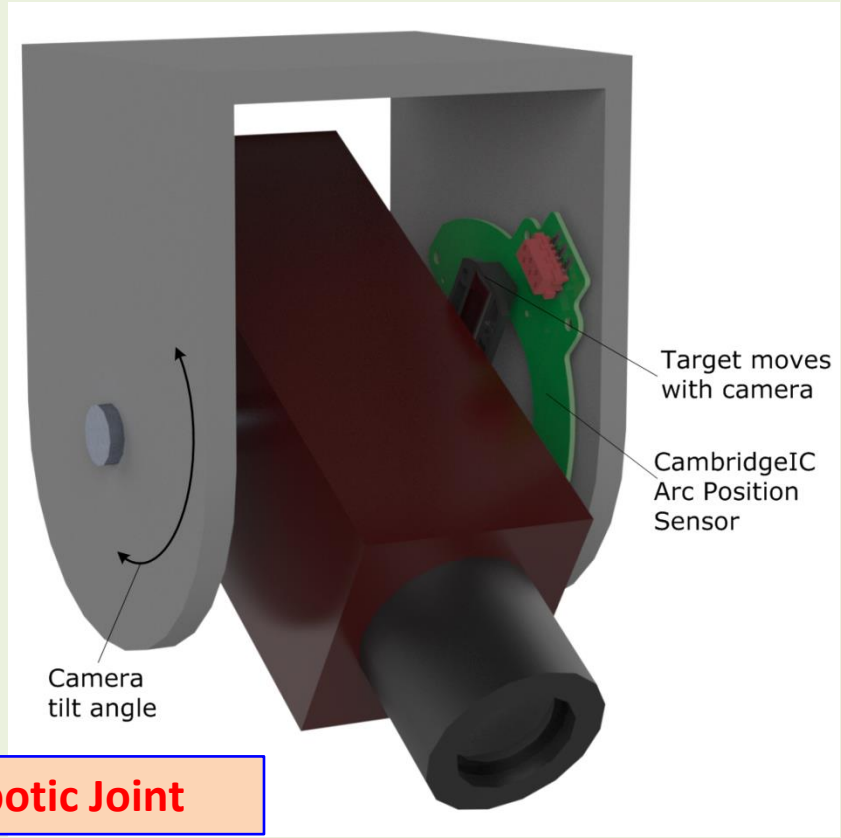




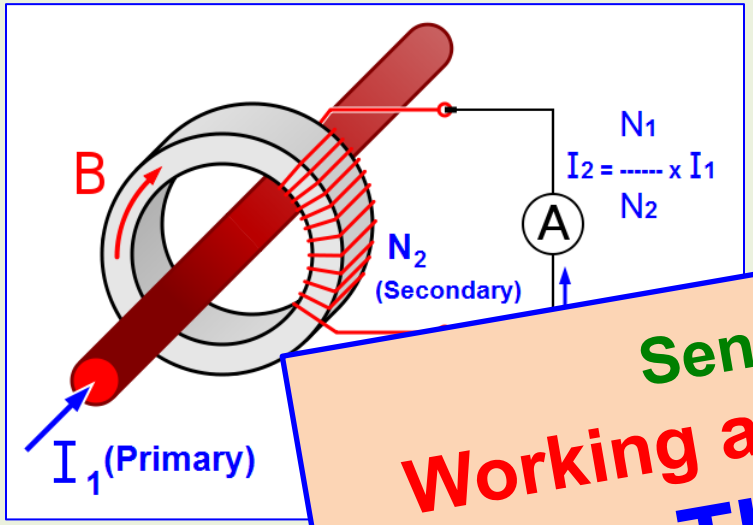
Tilt sensor : Applications

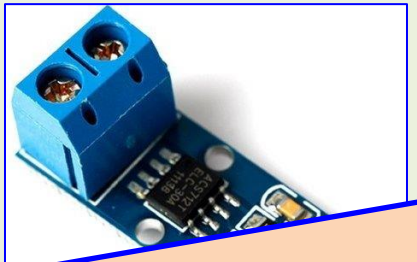


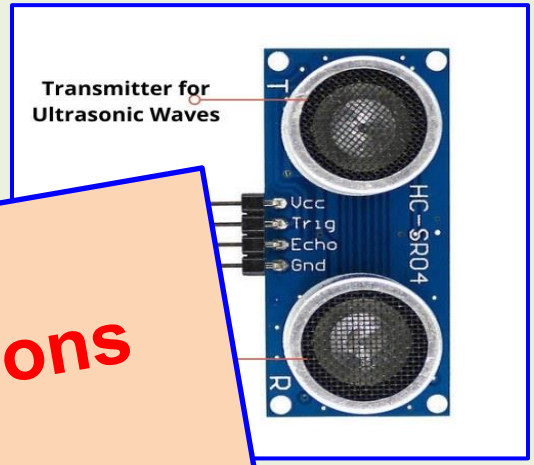
Gaming controller



Robotic Joint







Sensors – 1.2
Working and Applications
Thanks !
FY – DESH – VIT