CH-05 INTERNET OF THINGS

CONTENTS:-

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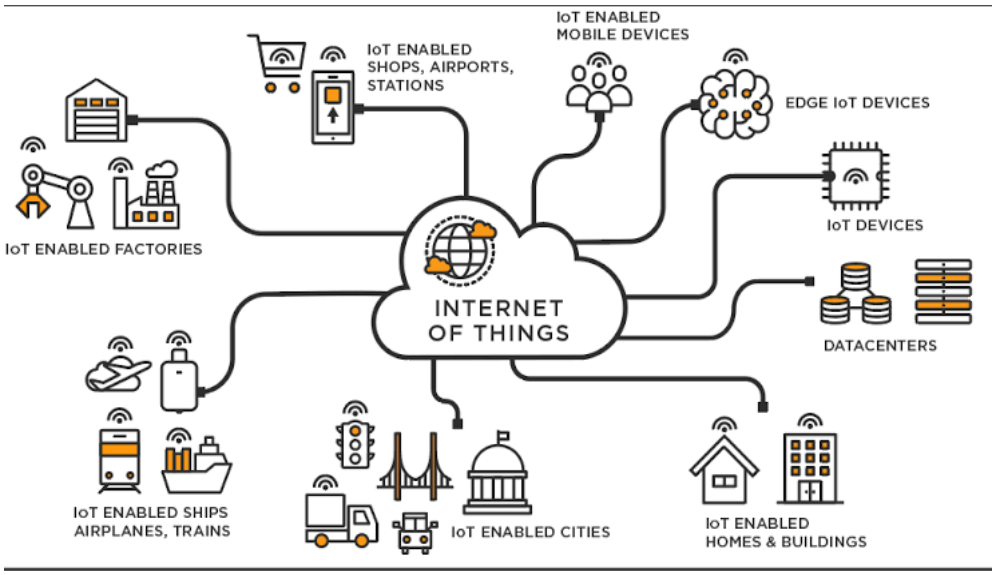
1.Introduction to IOT:-

The Internet of things (IoT) describes the network of physical objects-"things"-that are embedded with sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the internet.

IoT makes virtually everything "smart," by improving aspects of our life with the power of data collection, Al algorithm, and networks. The thing in Iot can also be a person with a diabetes monitor implant, an animal with tracking devices, etc. This Iot tutorial for beginners covers all the Basics of IoT.



Four fundamental components of IOT are:-

1. Sensor/Device.

2. Connectivity.

3. Data processing.

4. User interface.

1) Sensors/ Device:- Sensors or devices are a key component that helps you to collect live data from the surrounding environment. All this data may have various levels of complexities. It could be a simple temperature monitoring sensor, or it may be in the form of the video feed.A device may have various types of sensors which performs multiple tasks apart from sensing. Example, A mobile phone is a device which has multiple sensors like GPS, camera gyroscopic sensors etc.

2) Connectivity:- All the collected data is sent to a cloud infrastructure. The sensors should be connected to the cloud using various mediums of communications. These communication mediums include mobile or satellite networks, Bluetooth, WI-FI, WAN, etc.

3) Data Processing:- Once that data is collected, and it gets to the cloud, the software performs processing on the gathered data. This process can be just checking the temperature, reading on devices like AC or heaters. However, it can sometimes also be very complex like identifying objects, using computer vision on video.

4) User interface:- The information needs to be available to the end-user in some way which can be achieved by triggering alarms on their phones or sending them notification through email or text message. The user sometimes might need an interface which actively checks their IoT system. For example, the user has a camera installed in his home. He wants to access video recording and all the feeds with the help of a web server.

2.SENSING DEVICE:-

A sensor is an element in a measurement system that accuries a physical parameter and change it into a signal. The sensing element may or may not be in contact with the process but provides the output. The output depends upon the changes in the input and process parameters that are to be monitored.Sensors is used to measure physical quantity such as position, force, distance,strain, vibration, temperature, acceleration or image.

1. Position sensor:- Position sensors are used to determine the position of some object with reference point. It is used to measure the presence of a part, determine the position of a part, measure size.

2. Proximity sensors:- It is pilot device used to detect the presence of an object without making any physical contact. They are used to determine when an object has moved to within some particular distance.

Various position sensors commonly used in measurement are:

1) Photoelectric sensors.

2) Hall effect sensors.

3) Optical sensors.

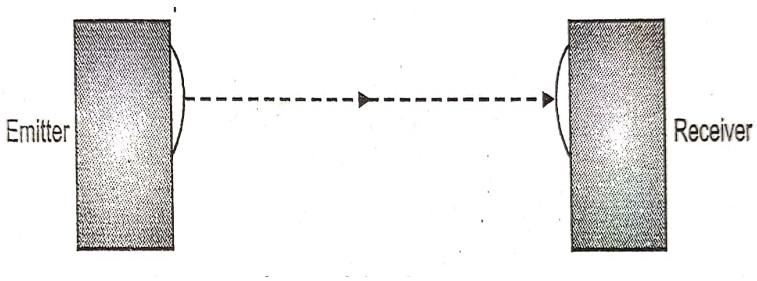
4) Eddy current proximity sensors.

5) Inductive sensors.

6) Capacitive sensors.

1) Photoelectric sensors:-

Photoelectric sensors uses a beam of light to detect the presence of an object that blocks or reflect the light beam. A beam of light passes from the source and a photo transistor is used to detect the light radiation.



Application of Photoelectric sensors:-

1. To measure the thickness of a sheet.

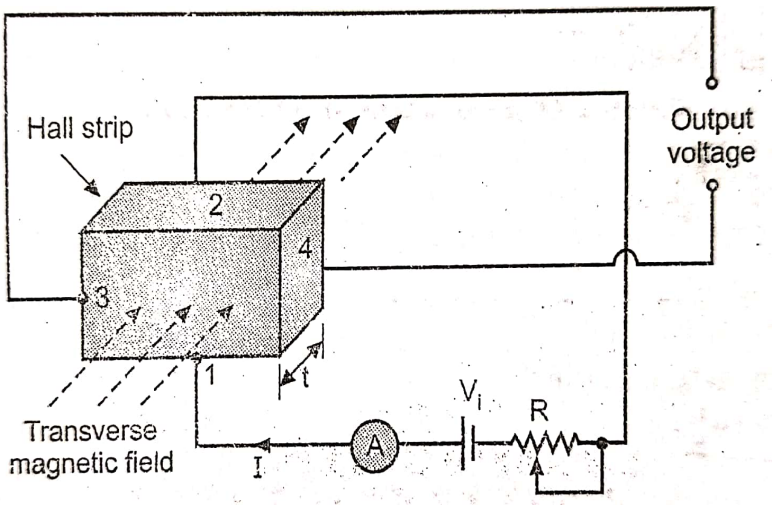
2. Diameter of a rod.

3. Optical position detection.

4. Light barrier detection.

2) Hall effect Sensors:-

When a beam of charged particles passes through a magnetic field, the beam is deflected from its straight line due to the force acting on the particles. A current flowing in a conductor such as a beam of moving charges and thus can be deflected by a magnetic field, called hall effect.Hall effect Sensors have the advantage like. It can operate as a switch. It cost less than mechanical Switches.



Application of Hall effect Sensors:-

1. It is used as a magnetic switch for electric transducer.

2. It is used for the measurement of position, displacement.

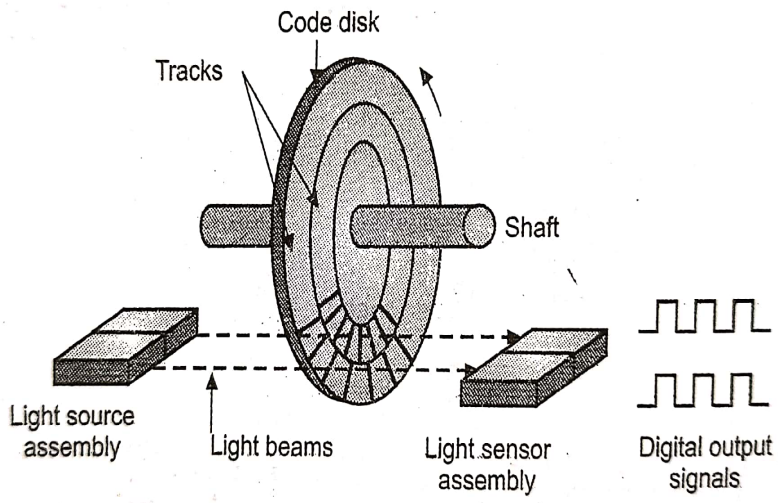
3. It is used for measurement of current.

4. It is used for measurement of power.

3) Optical Encoder:-

Am encoder is a device that provides output in response to a linear or angular displacement. An optical encoder is a suitable transducer for the measurement of angular position and has the added advantage of having a digital output. An optical encoder has four main parts :- A light source, a code disk, a light detector and a signal conditioner.

Most rotary encoder are composed of a glass or plastic code disk with a photographically deposited radial pattern organized in tracks. A digital optical encoder is a device that converts motion into a digital pulses.

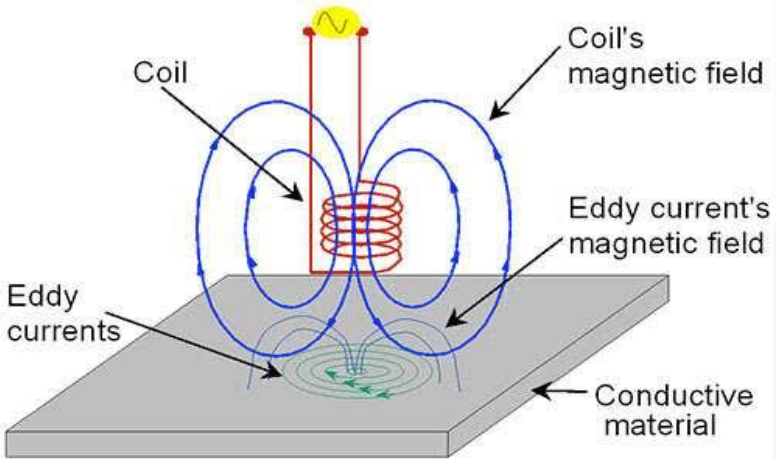


Applications of Optical Encoder:-

It is used for rotor, Shafts, pistons of actuating devices such as rotary machines these encoders are used to detect the movement, position,angle, acceleration and direction.

4) Eddy current proximity sensor:-

When alternating current is supplied to the coil, an alternating magnetic field is produced. If there is a metal object in close proximity of this alternating magnetic field,the Eddy current is induced in it. This Eddy current will produce a magnetic field itself, distorting the magnetic field responsible for their production and the impedance of the coil changes the amplitude of the alternating current.

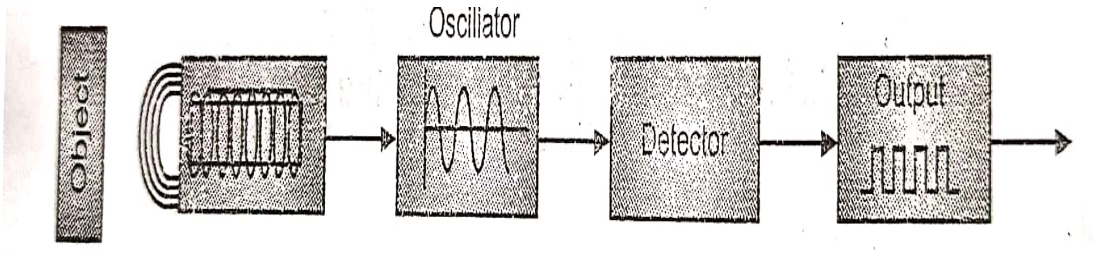


Applications of Eddy current proximity sensor:-

Eddy current proximity sensors are primarily used for displacement and position measurement of electrically conductive targets. They are generally used for measuring ferromagnetic and non-ferromagnetic materials. They are suitable for applications in harsh industrial environments due to their superior tolerance for oil, dirt, dust, moisture and magnetic interference fields

5) Inductive Sensor:-

An inductive sensor consists of a coil wound around a ferrous metallic core, detector circuit and solid state output. With the supply voltage, the oscillator operates to produce a high frequency field. When a metallic object is placed near the field, eddy current are induced on the surface of the object. Consequently, these current result in a loss of energy in the oscillator circuit, which in turn causes a smaller voltage of oscillation. The detector circuit recognises a changes in the amplitude and generates a signal that will result in the output device being ON or OFF.



Applications of inductive Sensor:-

1. Measurement of displacement or position.

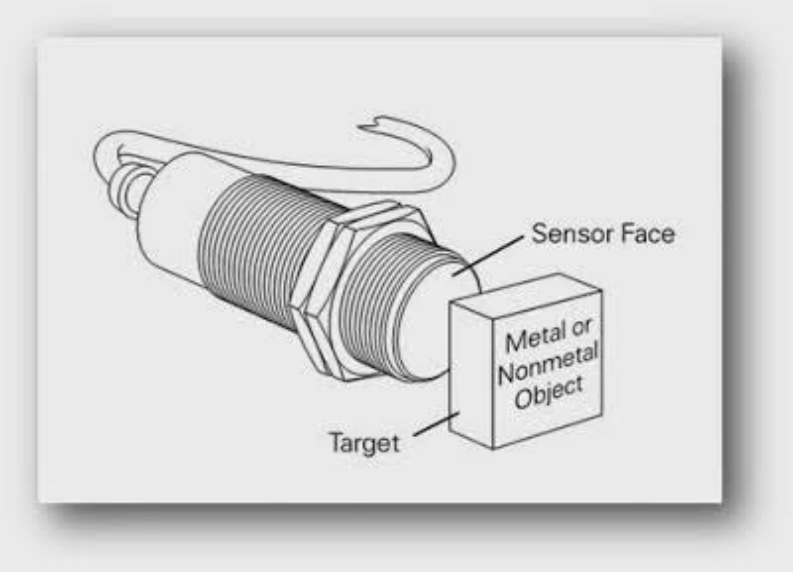
2. Automobile industry.

3. Machine building industry.

4. Wood and paper industry.

6) Capacitive Sensor:-

Capacitive proximity sensor is a device actuated by both conductive and non conductive material. The pair of plates of a capacitor is separated by some distance. Depending upon the separation,the capacitance measured will be changed. Therefore, proximity of the object can be detected if one of the plates of the capacitor acts as a switch and other as the metal object whose proximity is to be detected.



Applications of capacitive sensors:-

Capacitive sensors are designed for non-contact measurement of displacement, distance and position, as well as for thickness measurement. Due to their high signal stability and resolution, capacitive displacement sensors are applied in laboratories and industrial measurement tasks. In production control, for example, capacitive sensors measure film thickness and application of the adhesive. Installed in machines, they monitor displacement and tool positions.

3.Introduction to Artificial intelligence:-

Artificial Intelligence is an approach to make a computer, a robot, or a product to think how smart human think. Al is a study of how human brain think, learn, decide and work, when it tries to solve problems. And finally this study outputs intelligent software systems. The aim of Al is to improve computer functions which are related to human knowledge, for example, reasoning, learning, and problem-solving.According to the father of Artificial intelligence John McCarthy, it is the science and engineering of making intelligent machines, especially intelligent computer programs.

It is a way of making computer, a computer-controlled robot, or a software think intelligently in the similar manner the intelligent human think.

Advantages of Al:-

1. It reduces human Error.

2. Helping in repetitive jobs.

3. It helps in Fast decision making.

4. It is Making human life easier.

5. Provides digital assistance

6. Reduces human risks.

7. Available in service 24x 7.

Disadvantages of Al:-

1. Al enabled machine cost high

2. It cannot perform out of the box task.

3. It has no emotion s or ethics.

4. It is making human race lazy and dependent.

5. It is a big reason for rise in unemployment

6. It has lack of creativity.

4.Relation between Al and IOT:-

The Internet of Things, or lot, describes a network of physical objects, and by their extension animals or people, all of which are connected to the Internet and able to share data via this connection. The lot therefore essentially collects massive sets of data about any number of attributes, providing the "intelligence" required by Al. Without the collation of this data from connected sensors, actuators, and similar, Al doesn't have the level of information it needs to analyse data patterns and learn from them on an ongoing basis (known as machine learning). While many Al applications couldn't function without the lot providing constant data updates, similarly many lot strategies offer limited value without Al to analyse the data they collate.

5.ACTUATING DEVICES:-

Actuation is the process of conversion of energy to mechanical form. A device that accomplishes this conversion is termed as actuator. Actuator play a very important role while implementing control. The microcontroller provides command signal to the actuator for actuation. Various types of actuators are used depending upon the load involved. An actuator is a type of motor that is responsible for moving or controlling a mechanism or system. It is operated by a source of energy like electrical current, hydraulic fluid pressure, or pneumatic pressure and convert energy into motion.

The actuators are broadly categorised into following groups:-

1. Electromechanical Actuators.

2. Fluid power Actuators.

3. Electrical Actuators.

4. Mechanical Actuators.

5. Active material based Actuators.

Electro Mechanical Actuators:-

Electro mechanical actuator converts electrical energy into mechanical energy and the principle involved is, when an electric current is passed through a group of wire loops placed in a magnetic field, the loop rotates and the rotating motion is transmitted to a shaft providing useful mechanical work as the output. Electro mechanical actuators are main components for any industry and available in many ranges.

Some types of Electro Mechanical Actuators:-

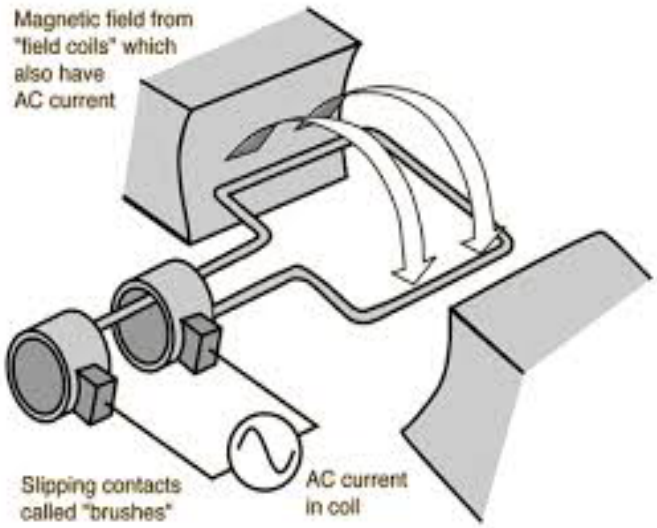
1. AC motor.

2. DC motor.

3. Stepper motor.

1. AC MOTOR:-

The motor that converts the alternating current into mechanical power by using an electromagnetic induction phenomenon is called an AC motor. This motor is driven by an alternating current. The stator and the rotor are the two most important parts of the AC motors. The stator is the stationary part of the motor, and the rotor is the rotating part of the motor.



Advantages of AC Motor:-

1. They have high degree of reliability and requires less maintenance.

2. Voltage can be step up and down.

3. Less energy loss transmission.

4. Simple slip ring commutator is used.

Disadvantages of AC motor:-

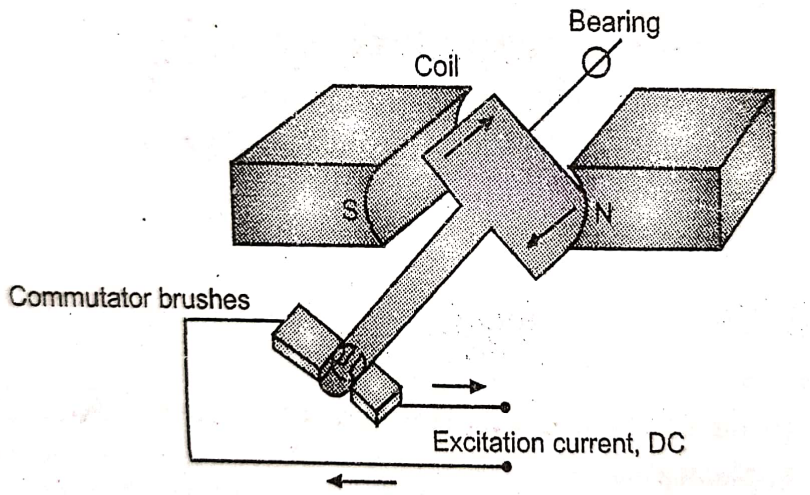
1. Speed control is very complex and difficult to DC motor.

2. Back emf opposes supplied emf.

3. Emits EMR so wire need insulation and shielding.

2. DC Motor:-

A direct current (DC) motor is a type of electric machine that converts electrical energy into mechanical energy. DC motors take electrical power through direct current, and convert this energy into mechanical rotation. In simplest form of a DC motor, the stationary element consist of a permanent magnet to produce static magnetic field around two poles pieces. The rotating element consists series of coil placed on the periphery of a rotating body called armature which is connected to a source of DC current through a switch mounted on the shaft called commutator.



Advantages of DC motor:-

1. DC motor are chosen due to torque requirement and their inherent nature of being controlled efficiently.

2. The speed and torque can easily varied.

3. High starting torque. DC series motors will have a starting torque as high as 500% compared to normal operating torque.

Disadvantages of DC motor:-

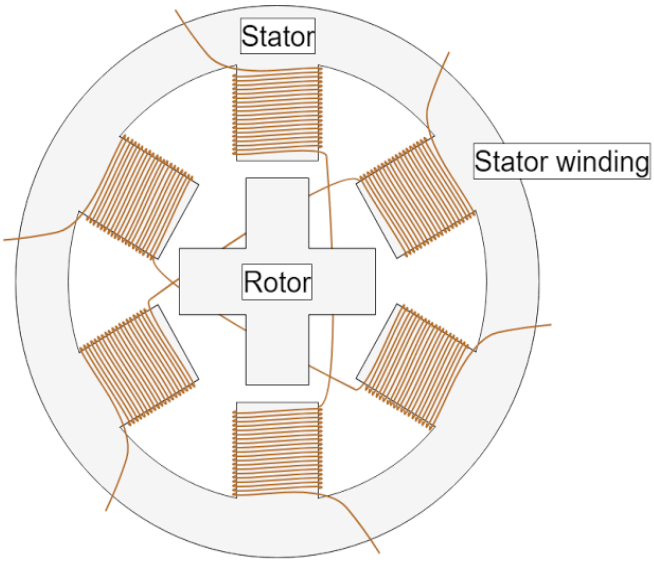
1. High intial cost.

2. Maintenance cost is high due to presence of commutator and brush gear.

3. Cannot operate in explosive and hazard condition due to sparking occurs at brush.

3.Stepper Motor:-

A stepper motor, also known as step motor or stepping motor, is a brushless DC motor that divides a full rotation into a number of equal steps. The motor's position can then be commanded to move and hold at one of these steps without any position sensor for feedback (an open-loop controller), as long as the motor is carefully sized to the application in respect to torque and speed. It is a rotating machine which converts DC voltage into a series of discrete rotational steps.



Advantages of Stepper motor:-

1.Stepper motor provide excellent response during start, stop and reverse mode.

2.It is highly reliable since no brushes or commutator are used. Its life time depend life of the bearing.

3. It is able to run at wide range of speeds, including very slow speeds without reduction gearing.

Disadvantages of Stepper motor:-

1.Noise and vibration

2.Resonance occurs if it is not properly controlled.

3. Progressive loss of torque at high speeds. Hence it is not easy to operate at extremely high speeds.