

1.1 Active and Passive Sensors:

Active and passive sensors are two fundamental categories in the world of sensor technology, commonly used in various applications, including IoT and robotics.

Active Sensors

- **Definition:** Active sensors are those that require an external power source to operate. They emit energy in the form of waves or signals and measure the response that comes back after interacting with the environment.
- **Examples:**
 - **Radar:** Emits radio waves and measures the time it takes for the echoes to return, used in weather monitoring and vehicle speed detection.
 - **LiDAR:** Uses laser light to measure distances by calculating the time it takes for the light to reflect back, often used in autonomous vehicles.
 - **Ultrasonic Sensors:** Emit ultrasonic waves and measure the time of flight for the waves to return, used in distance measuring and object detection.
- **Advantages:**
 - Can be used in a variety of environmental conditions.
 - Capable of providing information about the target's velocity and distance.
- **Disadvantages:**
 - Typically more expensive due to their complexity.
 - Requires more power to operate.

Passive Sensors

- **Definition:** Passive sensors do not emit any energy themselves. Instead, they detect and measure natural energy that is emitted or reflected by the objects or surroundings.
- **Examples:**
 - **Photocells:** Detects light intensity and is commonly used in automatic lighting systems.
 - **Thermometers:** Measure temperature by detecting thermal radiation.
 - **Infrared Sensors:** Detect infrared radiation (heat) emitted by objects, used in night-vision equipment and heat-seeking devices.
- **Advantages:**
 - Generally simpler and cheaper to produce.
 - Require less power to operate.
- **Disadvantages:**
 - Limited to the energy naturally available in the environment.
 - May have slower response times compared to active sensors.

Both types of sensors play crucial roles in data collection across various fields, and the choice between them depends on the specific requirements of the application, such as cost, power availability, and environmental conditions.