Types of sensors in IoT

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BT23EEE096

IoT and sensors

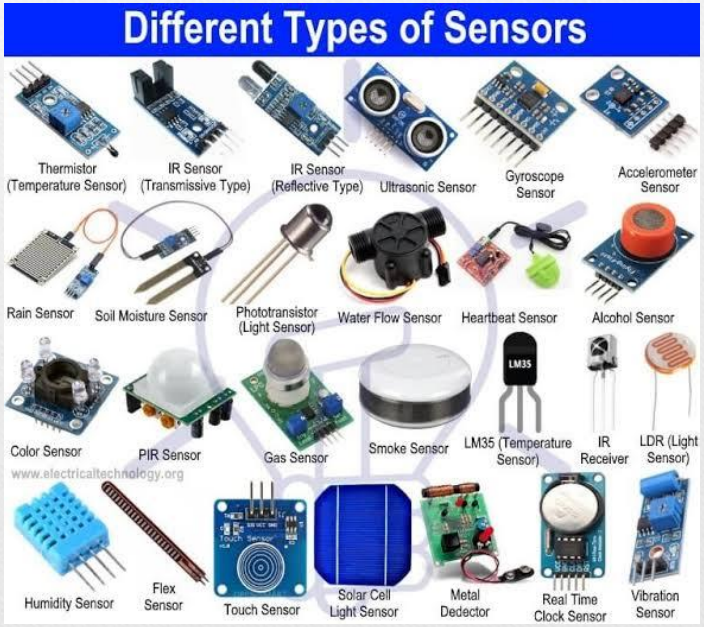
- The Internet of Things (IoT) is a network of physical devices, interfaces, and other items embedded with sensors, actuators, electronics, and connectivity. These devices collect data from their environment through IoT sensors and communicate it to systems. Data from **IoT sensors** can be used better to understand a system or process for further actions. It can also prevent tragedies, decrease usage costs, and simplify your everyday life.

Introduction to IoT sensors

- IoT Sensors are electronic chipsets or modules that sense the ambient or system conditions and transmit that data to the Internet through a gateway. These different sensors can function through physical contact, radiation, or magnetic fields.
- There are two main types of sensors used in IoT applications:
- **Passive sensors:** detect changes in their environment without any dedicated power supply (e.g., temperature)
- **Active sensors:** require some form of power source to function (e.g., battery)

Types of sensors

- IoT sensors are often combined with other technologies, such as AI and cloud computing. For example, a sensor might measure temperature and humidity in a room and transmit that data to a cloud-based database, where it is analyzed to perform necessary operations. Below are different types of sensors used in daily life.

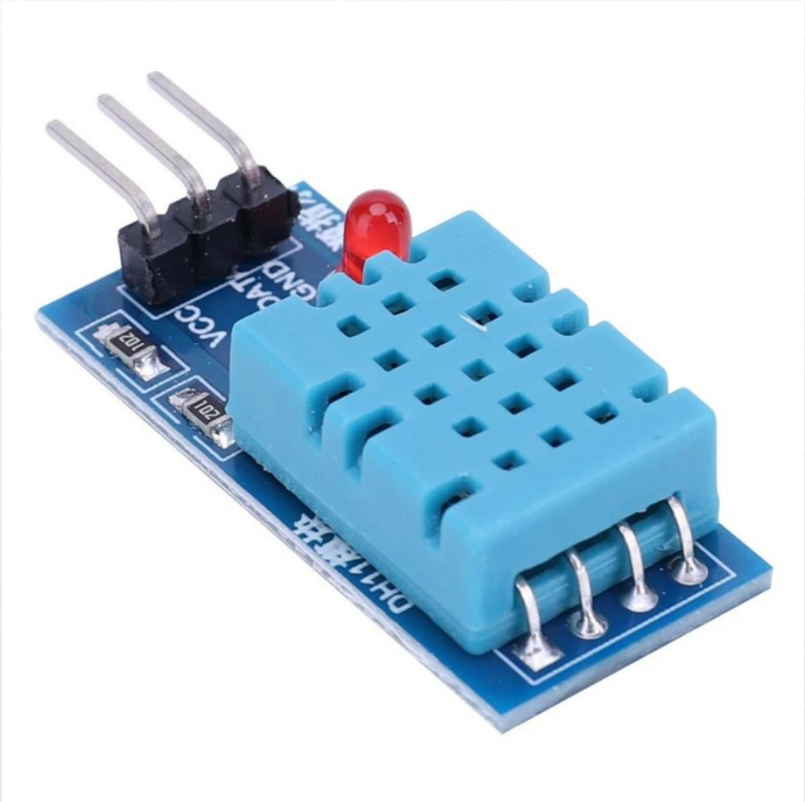


Temperature sensor

Temperature sensors or thermal sensors can detect the temperature of an object, surface, or environment. A temperature sensor measures and sends the temperature of something or someone to a cloud or other devices via a network. For example, a device like a thermostat is temperature-controlled using temperature sensors.

Humidity Sensors

Humidity sensor detects changes in moisture levels in different mediums like air, liquids, or solids. Humidity sensors detect the layer's response to electronic signals through an electronic circuit that converts electrical signals into digital ones; Such humidity detection can also be used in thermostats and other wetness detection solutions.



Fire Detection Sensors

As the name suggests, fire detectors are used to detect smoke and heat. Such detection can be helpful in industrial operations and smart buildings. For example, fire detection can detect smoke and heat from combustion processes within combustion chambers like furnaces.

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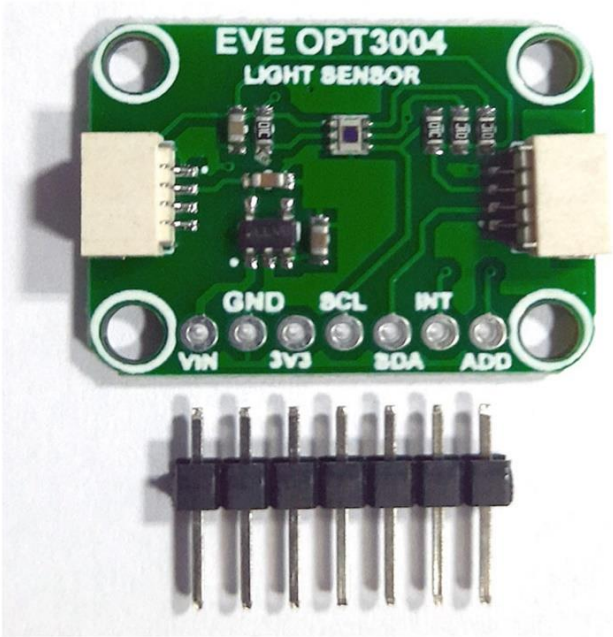
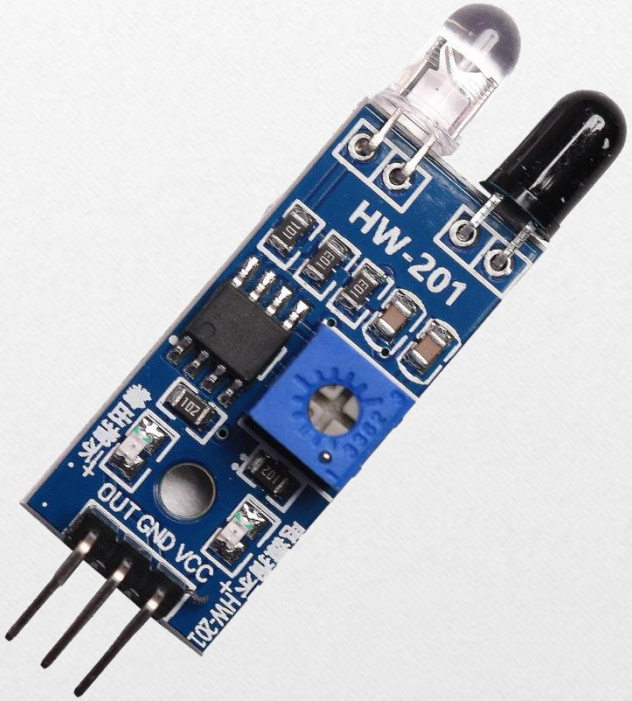


Proximity Sensors

Proximity sensors can help identify if there are nearby objects, animals, or humans passing by. Such sensors detect the presence and take further necessary actions such as turning on lights, recording camera footage for safety, or even helping with car parking. Infrared sensors, ultrasonic sensors, optical sensors, and LiDAR can help with such proximity detection.



Gas Detection Sensors

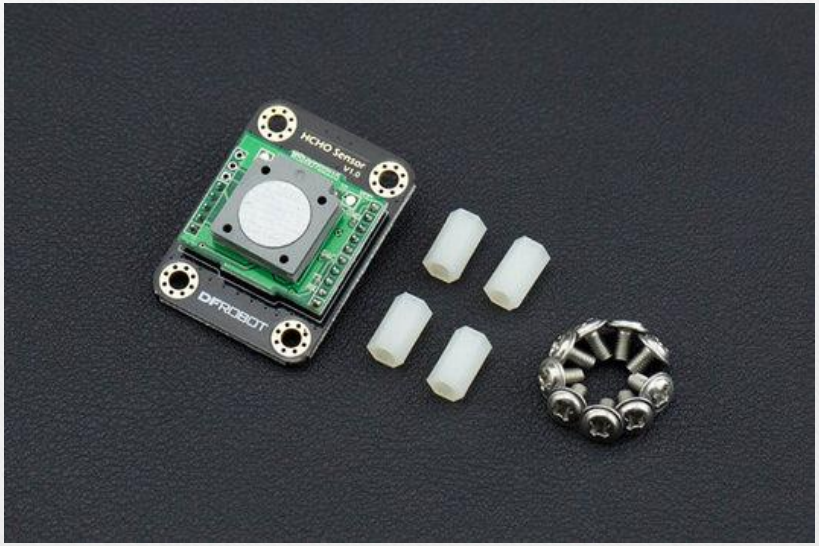
Gas leak detectors can be used to identify a particular gas in the surroundings. It can help detect potentially dangerous gasses to avoid any harmful accident or effects on a particular user. An example of such detection can be detecting hydrogen sulfide, a gas found in natural gas pipelines that causes explosions if not detected in any leaks.

IR sensors

*I*nfrared (IR) sensors have become increasingly popular in IoT projects developed by IoT companies due to their ability to emit and detect infrared radiation to sense the surrounding characteristics. They are particularly useful in healthcare, as they simplify monitoring blood pressure and blood flow. They are also commonly used in everyday smart devices such as smartphones and smartwatches. Given their wide range of applications, IR sensors are poised to play an important role in the smart home industry.

Chemical sensors

Those essential components are used in various industries to detect liquids or air composition changes. For example, in the industrial sector, chemical sensors can be used for environmental monitoring and process control to ensure that the production process is safe and efficient. In medicine, chemical sensors can detect glucose levels in a diabetic patient's blood or analyze breath samples for disease diagnosis. In bigger cities, chemical sensors can monitor air quality and detect harmful chemicals to protect the population.



Pressure sensors

Pressure sensors measure the amount of pressure applied to a liquid or gas. Pressure sensors, which are used to detect the rise and fall of pressure, are used for leak detection and used to maintain water and heating systems in real time.

Motion sensors

These sensors use infrared radiation or ultrasonic waves to detect motion. Safety and surveillance is a common use case as motion sensors can detect the presence of an object or person from the heat it emits or by bouncing ultrasonic waves off the object.

Electric Current Sensors

These sensors measure the amount of electricity running through a wire. They do so by monitoring the magnetic field the current generates along the wire. Electric current sensors are often used to track energy consumption and for remote and real-time monitoring of power systems to manage energy needs in places like data centers.

Flow Sensors

Flow sensors measure how quickly a liquid or gas flows past a certain point in a tube or pipe. A flow rate that's too fast or too slow could indicate a problem, like a leak. Cities typically use flow sensors to help manage water systems and detect leaks. These sensors are also a key component of smart metering devices, which monitor how water or other resources like natural gas are used and consumed.

Air Quality Sensors

Air quality sensors measure levels of pollution, carbon dioxide and other particulates in the air. Air quality sensors gather data about what's in the air and transmit their findings to the cloud. Cities typically use devices with air quality sensors so they can access real-time air quality conditions to issue warnings to residents if needed and track trends for study. Air quality sensors are being used in homes as well, detecting harmful particulates that could be indoors from appliances like gas stoves, which could warn residents to open a window or turn on an exhaust fan.

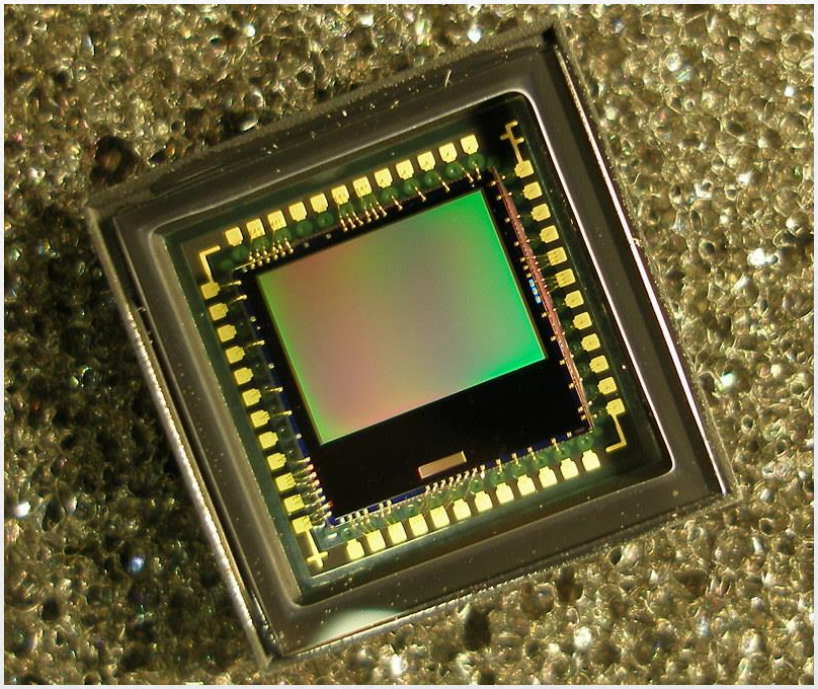
Accelerometers

Accelerometers measure acceleration — basically the change in speed, direction and intensity of movement. Accelerometers are used to collect data from connected devices such as wearables, medical alert devices, cameras and cars to track activity. Tablets and smartphones also rely on accelerometers to know when to rotate displays based on the device's physical orientation

Figure 1 - MEMS Accelerometer

Cameras

Cameras and image sensors capture visual data and images. Everything from smart refrigerators to autonomous vehicles rely on cameras to detect objects and monitor their surroundings. Cameras are also critical to smart cities as well as home and business security — think Ring cameras notifying a homeowner when someone is at their door, even if they aren't there themselves. Cameras also play a role in factory and warehouse automation, helping perform tasks like product inspections.



Gyroscopes

Gyroscopes sense a device's angular velocity, the speed of rotation around an axis. In industrial settings, gyroscopes can be used to detect and identify safety issues, like careless forklift driving inside a warehouse or speeding delivery vehicles out on the road. They're typically used in conjunction with accelerometers for display orientation on smartphones, tablets and other connected devices like gaming consoles.

Radiation Sensors

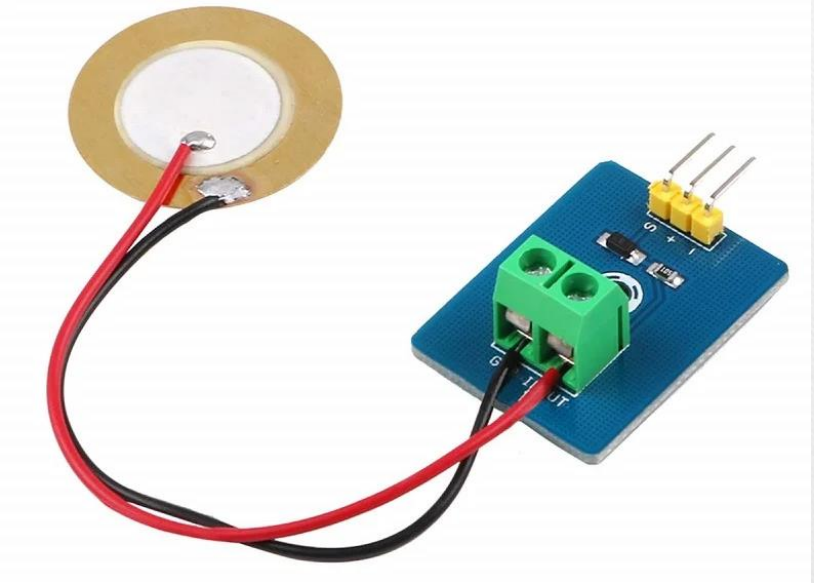
Radiation sensors can detect different radiations like gamma and x-radiation. The uses of these sensors are present in tasks including measurement, protection, and search.As the world has seen advancements in optical fiber-enabled radiation sensors, they offer improved sensitivity and sensing coverage. Yet the shape, length, and connection process of the extrinsic sensing materials can limit their application.

Ultrasonic Sensor

Ultrasonic sensors can determine the distance to an object. They emit ultrasonic waves and measure the time taken for these waves to bounce back after hitting the object.The effective range of these sensors can vary. It can be from a few centimeters to several meters, depending on the sensor and object properties. However, most sensors use the principle of measuring the propagation time of sound between send and receive.Some ultrasonic sensors use piezoelectric ceramics for transmission and reception. They generate electromotive force in proportion to the amount of mechanical force applied.

Piezoelectric Sensor

These sensors convert pressure or mechanical stress into an electrical voltage. They are widely used in pressure sensors, microphones, and accelerometers (used in airbags and motion tracking).



Liquid Level Sensor

Liquid level sensors are used to detect the level of substances including liquids, powders and granular materials. Many industries, including oil manufacturing, water treatment, and beverage and food manufacturing plants, use liquid level sensors. Waste management systems provide a common use case, as level sensors detect the level of waste in trash cans or bins.

Other sensors used in IoT

- The future use of IoT sensors is incredibly promising, and we can expect to see these devices integrated into even more aspects of our daily lives. For instance, in healthcare, wearable sensors can provide real-time monitoring of patients, allowing doctors to track vital signs and detect early signs of illness. IoT sensors can also be used to optimize energy usage and reduce waste in smart homes and buildings. They can even be applied to improve worker safety and efficiency in industrial settings. In agriculture, IoT sensors can monitor soil moisture levels, track crop growth, and detect early signs of pests or diseases.

Future of IoT

- As we continue to develop more advanced IoT technology, we can expect to see even more innovative uses of sensors in various applications, from smart cities to transportation. With the vast amounts of data that can be collected from these sensors, the possibilities for improving efficiency, sustainability, and quality of life are endless. IoT sensors are used in smart cities, homes, and factories. If there is an IoT solution, the chances are there is some IoT sensor involved in the process. They're also used across industries like agriculture, transportation, healthcare, and manufacturing. As we move towards a more connected and data-driven world, the future of IoT sensors is bright, and we can look forward to exciting developments in this field.