



# Devices

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# IoT devices

- An **Internet of Things (IoT) device** is any **physical object** that can **connect to the internet** and **exchange data** with other devices, systems, or cloud platforms, usually without direct human involvement.
- These devices form the **core** of the **IoT** ecosystem.

# What is an IoT device?

- An IoT device is any physical object that can
  - **Collect data** from its environment (using sensors),
  - **Process that data** (using a microcontroller or processor),
  - **Communicate** with other devices or systems (using the internet or a network)
  - **Act or respond automatically** (using actuators).

# Main components of an IoT device

Component	Function	Example
Sensors	Collect data from the environment	Temperature, light, motion sensors
Actuators	Perform actions based on data	Motors, LEDs, alarms
Processor / Microcontroller	Processes data and controls other parts	Arduino, ESP32, Raspberry Pi
Communication Module	Sends/receives data over a network	Wi-Fi, Bluetooth, ZigBee, 4G/5G, LoRa
Power Source	Provides energy	Battery, solar panel, adapter
Software / Firmware	Controls logic, communication, and decision-making/basic control	Python code or Embedded C/C++

# How IoT devices work

- **Sensing:** The device collects data (e.g., temperature = 27°C).
- **Processing:** The microcontroller analyzes or filters the data.
- **Communication:** It sends the data to the cloud or another device.
- **Decision Making:** The cloud or application analyzes the data.
- **Action:** The IoT device (or another system) performs an action based on results.
- **Example:** A smart thermostat senses room temperature → sends data to the cloud → cloud decides it's too hot → sends a command → thermostat turns on the air conditioner.

# Types of IoT devices (Cont.)

- IoT devices can be grouped by **application** or **domain**:

Category	Examples
Consumer IoT	Smartwatch, smart TV, smart lights, home assistants
Industrial IoT (IIoT)	Vibration sensors, industrial robots, machine monitors
Commercial IoT	Smart HVAC, smart parking, surveillance cameras
Smart City IoT	Smart streetlights, pollution monitors, traffic sensors
Agricultural IoT	Soil moisture sensors, weather stations, crop monitoring
Healthcare IoT	Heart rate monitor, blood pressure sensor, wearable ECG

# Types of IoT devices (Cont.)

- **Consumer IoT**

- IoT devices used in homes for personal convenience.
- Automates daily tasks like lighting, entertainment, and fitness tracking.

- **Industrial IoT (IIoT)**

- IoT technology used in factories and industrial environments.
- Monitors machines, detects failures, and improves production efficiency.

- **Commercial IoT**

- IoT systems used in businesses and commercial buildings.
- Manages energy, parking, security, and building operations.

# Types of IoT devices

- **Smart City IoT**

- IoT infrastructure used by cities for public services.
- Optimizes traffic flow, lighting, waste management, and environmental monitoring.

- **Agricultural IoT**

- IoT devices used in farming and agriculture.
- Tracks soil, weather, irrigation, and crop health to improve yield.

- **Healthcare IoT**

- Connected medical devices used for health monitoring.
- Measures vital signs, tracks patient conditions, and supports remote care.

# Examples of IoT devices



Device	Function	Connectivity	Application
Smartwatch	Tracks heart rate, steps, sleep	Bluetooth, Wi-Fi	Healthcare, fitness
Smart bulb	Adjusts brightness or color remotely	Wi-Fi, ZigBee	Smart home
Smart thermostat	Controls home temperature	Wi-Fi	Energy management
GPS tracker	Sends real-time location	GSM (data), GPS (position)	Transportation
Smart door lock	Unlocks with phone or code	Wi-Fi, Bluetooth	Security
Air quality sensor	Detects CO <sub>2</sub> , smoke, dust	LoRa, Wi-Fi	Smart city, environment
Smart irrigation system	Waters crops automatically	Wi-Fi, LoRa	Agriculture
Industrial robot	Performs automated tasks	Ethernet, 5G	Industry 4.0

# Characteristics of IoT devices

- **Connectivity:** Always connected to a network or cloud.
- **Automation:** Operate with little or no human input.
- **Scalability:** Can form large interconnected networks.
- **Energy Efficiency:** Often low-power or battery-based.
- **Security:** Must protect user data and prevent cyberattacks.
- **Interoperability:** Can communicate across multiple devices and platforms.

# Summary

Aspect	IoT Device Description
Definition	A smart, connected object that collects and shares data over the Internet
Main Parts	Sensors, processor, communication module, power, actuator
Core Functions	Sensing, processing, communicating, acting
Applications	Smart home, industry, health, agriculture, transportation, cities
Examples	Smartwatch, thermostat, GPS tracker, streetlight sensor

Thank you!

