# Welcome to Robotics

Exploring the Future of Technology

# Understanding the Field of Robotics

Robotics is a branch of Science, Technology, Engineering, and Mathematics (STEM) that deals with the design, manufacturing, and operation of robots.

It combines:

⚙ Mechanical Design

💻 Programming & Control

📡 Electronics & Sensors
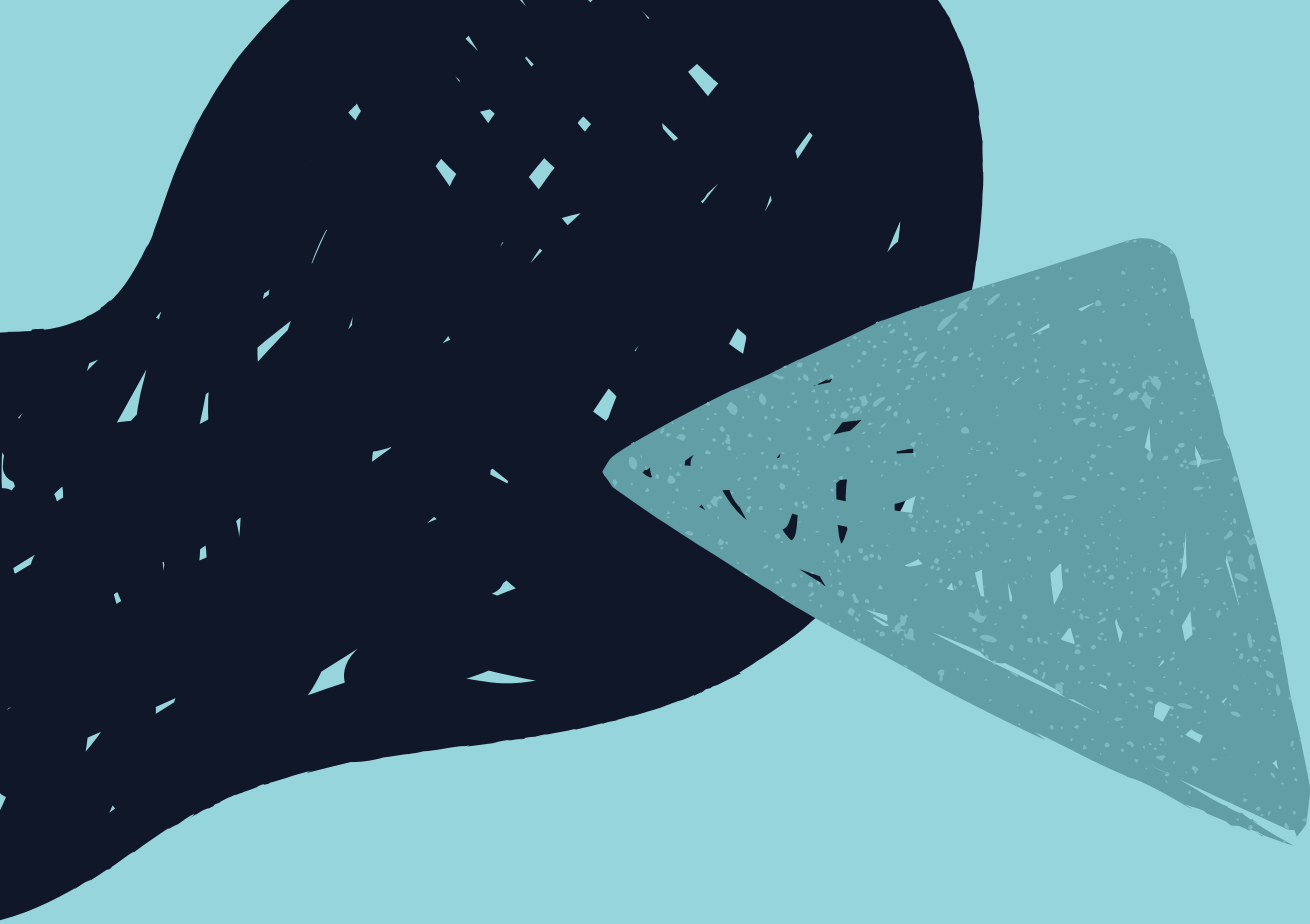
## Mechanical Engineering

Mechanics and dynamics are crucial for building robot structures.

## Computer Science

Programming enables robots to make decisions and process information.

## Electronics

Components like circuits and sensors allow communication and control in robots.

# Understanding Robots and Their Abilities

🤖 What is a Robot?
A robot is an autonomous machine that can:
- Sense its environment
- Perform computational thinking to process information
- Carry out tasks based on that information to produce an action

## Definition

A robot is an **automated device** capable of carrying out specific tasks.

## Abilities

Robots can **sense, decide, and act** in their environments autonomously.

## Intelligence

Many robots utilize **artificial intelligence** to enhance their decision-making processes.

# Robot vs. Machine Comparison

| Features | Robot | Machine | | |
|---|---|---|---|---|
| sensor (It can sense) | YES | YES | NO | NO |
| Microcontroller (It can think) | YES | NO | NO | NO |
| Actuator (It can act) | YES | YES | NO | YES |

# Is it a Robot?

| Example | Robot or Machine |
|---|---|
| Fan | |
| Remote controlled car | |
| Automatic gas leakage detector with buzzer | |
| Washing machine | |

# Understanding Different Parts of Robot

## 👁️ Sensor

Sensors help the robot sense the environment.
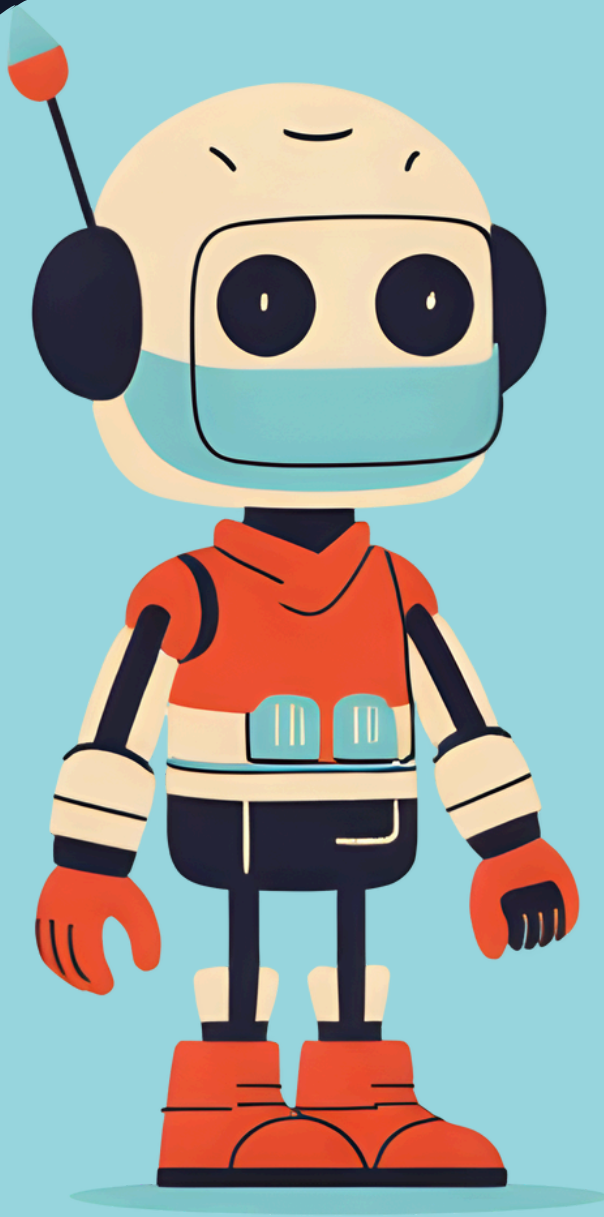Examples: Ultrasonic sensor, IR sensor, camera, gas sensor.

## 🧠 Microcontroller (Brain)

The microcontroller is the brain of the robot.
Examples: Arduino, ESP32, Raspberry Pi (basic computers).

## 💪 Actuator

An actuator is any device that performs an action —
it converts electrical signals into physical output like movement, light, or sound..
Examples: Motors, servos, solenoids.

## 🧱 Chassis (Body)
The chassis is the structure or body of the robot.
It holds all the components together.
Can be made of plastic, metal, wood, or 3D printed material.

## 🔋 Power Source
Robots need energy to work.
The power source gives electricity to the microcontroller, sensors, and actuators.
Examples: Batteries, USB power, solar panels.

# Understanding Sensors: Their Types and Functions

Sensors are devices designed to detect and respond to various physical inputs from the environment Here's a look at some common types of sensors:
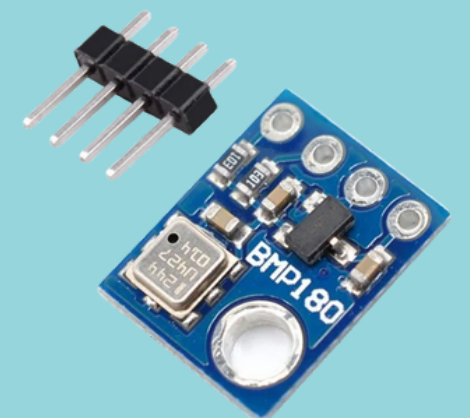
**Temperature Sensors**: These instruments measure temperature.
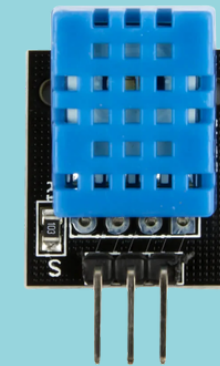
**Proximity Sensors**: These sensors detect the presence or absence of an object.

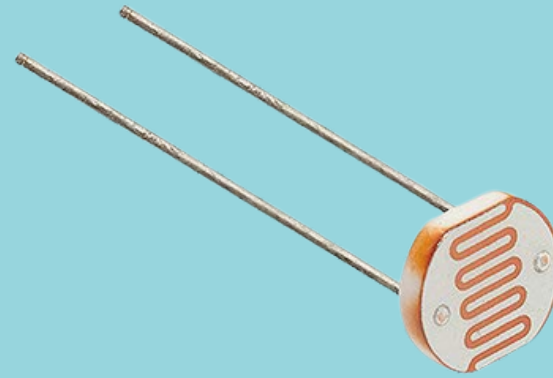**Pressure Sensors**: These measure the pressure of gases or liquids .

## ☀️ Light Sensor (LDR)
A light sensor detects the intensity of light. It is used to sense whether it's dark or bright.
Example: Turns on street lights automatically at night.

## 💧 Moisture Sensor
A moisture sensor measures the water content in soil or other surfaces.
Example: Used in smart farming robots to check when plants need water.
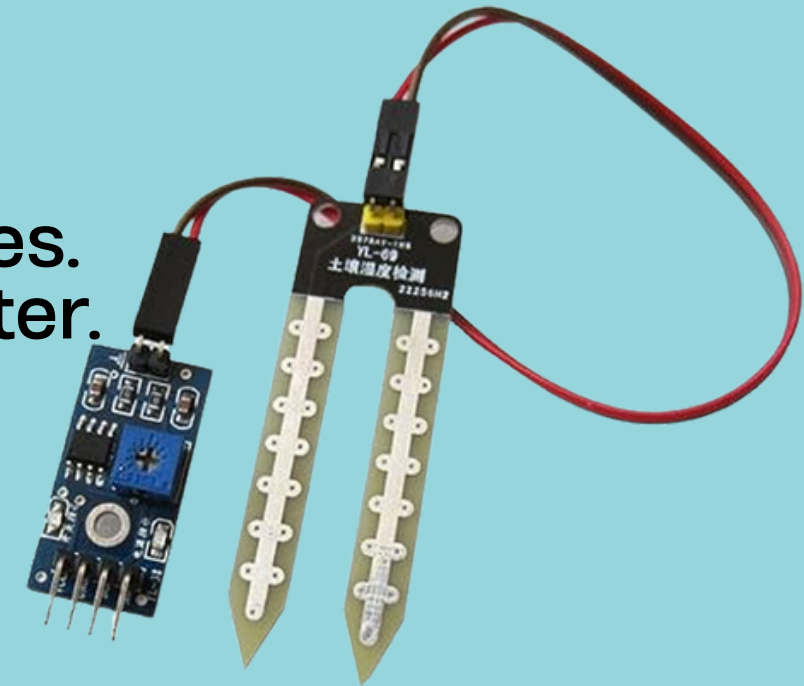
## 📷 Camera (Vision Sensor)
A camera sensor captures images or video. It helps robots see objects, faces, or movement.
Example: Used in robots for face detection, object tracking, or navigation.
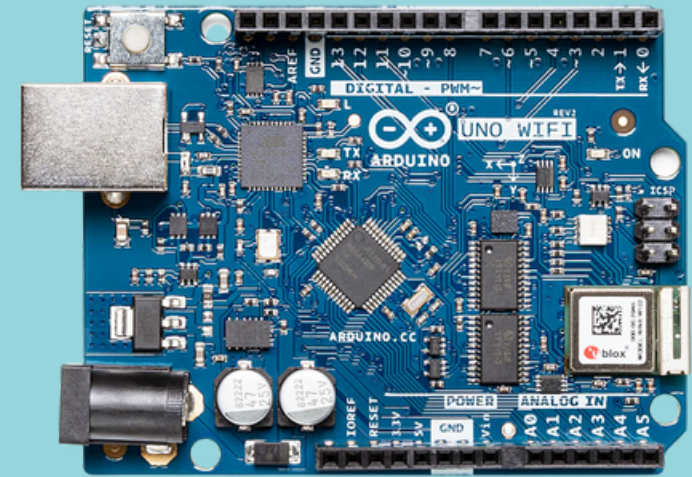
# What are Microcontrollers??

A microcontroller is the brain of a robot or electronic system.
It is a small computer on a single chip that can read data from sensors, process it, and control actuators like motors, LEDs, or buzzers.
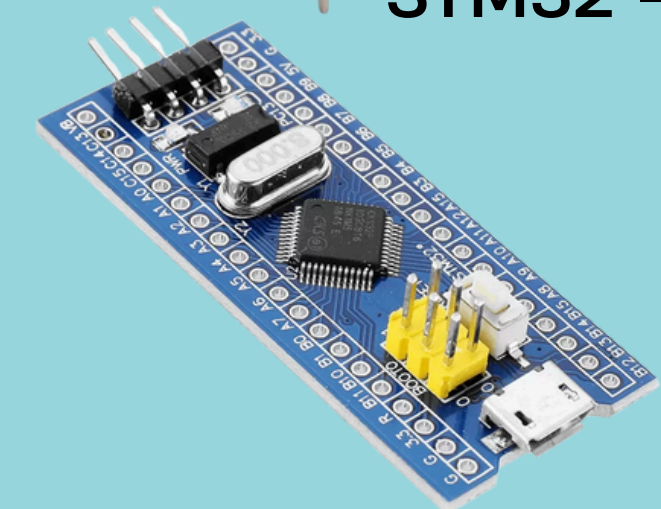
## Examples of Microcontrollers:

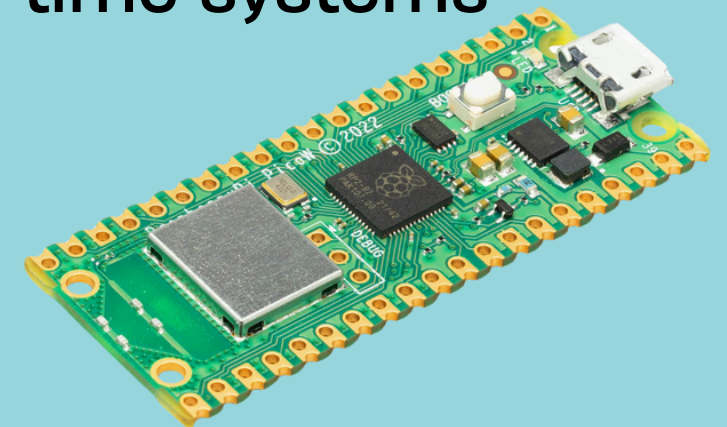Arduino Uno – very popular for beginners and robotics projects

ESP32 / ESP8266 – advanced microcontrollers with Wi-Fi/Bluetooth

STM32 – Powerful 32-bit microcontroller used in advanced robotics and real-time systems

Raspberry Pi Pico – small and powerful microcontroller

# What Are Actuator ???

Actuators are the parts of a robot that do the work.
They take commands from the microcontroller (brain) and
perform physical actions like movement, sound, or light.
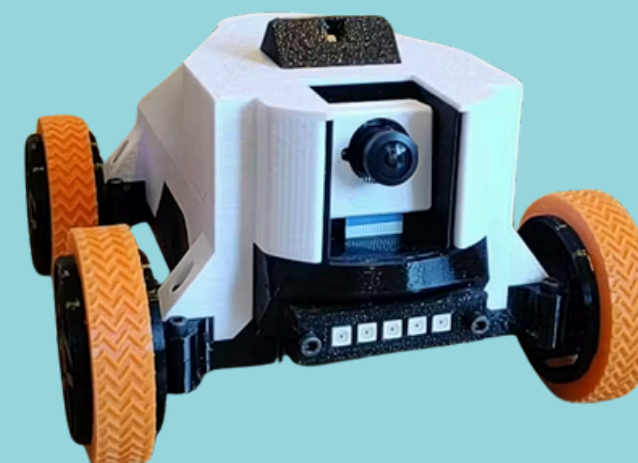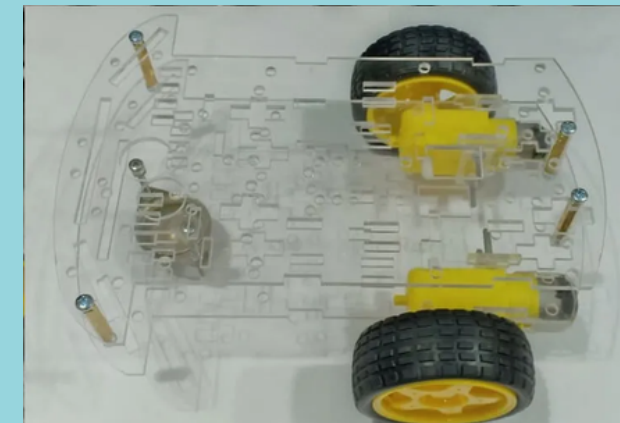
## Examples of Actuators:

| Actuator | What it Does | Example Use |
|---|---|---|
| **Motor** | Rotates or moves something | Robot wheels |
| **Servo Motor** | Moves to a specific angle | Robotic arms, sensors on servos |
| **LED** | Lights up | Indicators, eyes of robot |
| **Buzzer** | Makes a sound | Alerts, alarms |
| **Speaker** | Plays sound or music | Talking robots, sound effects |
| **Relay** | Turns high-power devices on/off | Home automation robots |
| **Display** | Shows text or images | Robot face, data screens |
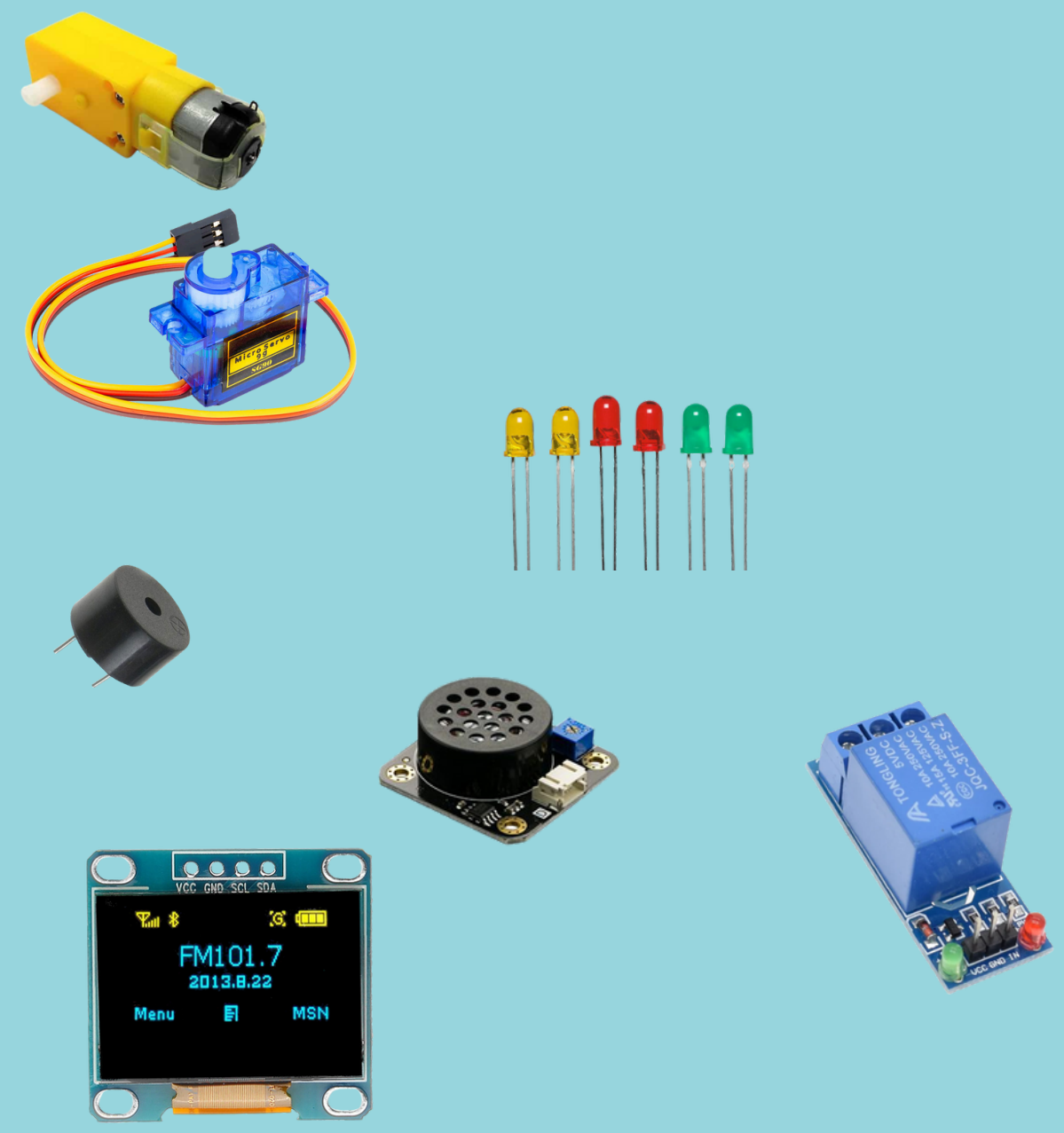
# What is a Chassis in Robotics?
The chassis is the body or frame of a robot.
It holds and supports all the parts like sensors, motors, microcontroller, and batteries.

| Material | Features |
|----------|----------|
| **Plastic** | Lightweight and easy to shape |
| **Metal** | Strong and durable, used in big robots |
| **Acrylic** | Transparent, used in educational kits |
| **Wood** | Cheap and DIY-friendly |
| **3D Printed** | Custom shapes, light, and creative |
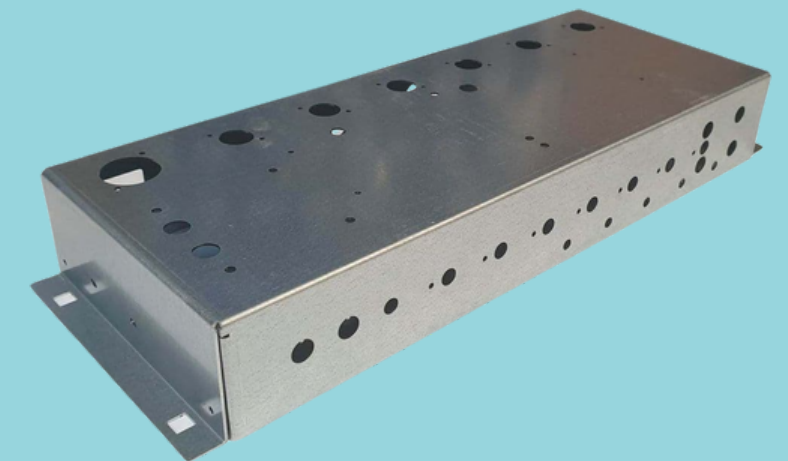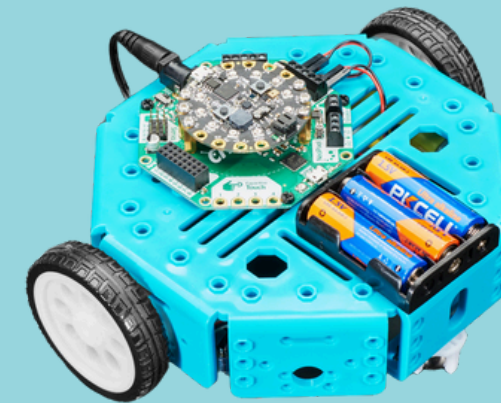
# What Are Power Sources??

A power source is what gives electricity to the robot so it can work.
Without power, the robot's brain (microcontroller), sensors, and actuators cannot function.

| Power Source | Description | Example Use |
|---|---|---|
| **Battery (Li-ion / Li-Po)** | Rechargeable, lightweight, high energy | Drones, RC robots, Arduino bots |
| **AA/AAA Battery** | Non-rechargeable or rechargeable | Small robots, toys |
| **Power Bank** | Portable and rechargeable via USB | Arduino or ESP32 projects |
| **Solar Panel** | Converts sunlight into electricity | Solar robots, eco-friendly bots |
| **Power Adapter (DC)** | Plugs into wall socket, constant power | Stationary robots or testing |
| **USB Power** | From computer or adapter, used for coding | Programming Arduino, small robots |

# Types of Robots and Examples

Robots come in many types based on what they do and where they work.

🚁 Aerial Robots (Drones)
Robots that fly in the air
Used in photography, surveillance, delivery, agriculture
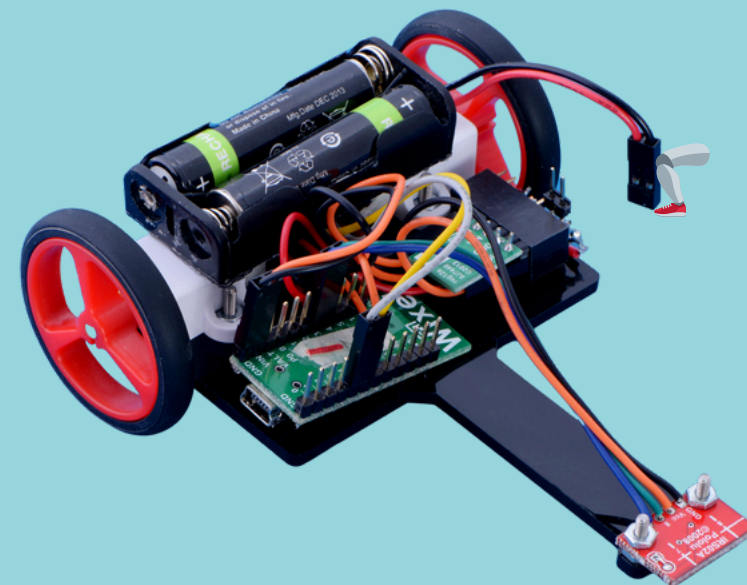🛸 Example: Camera drone, delivery drone

🚗 Mobile Robots
Can move around on wheels or legs
Used in exploration, cleaning, delivery, rescue
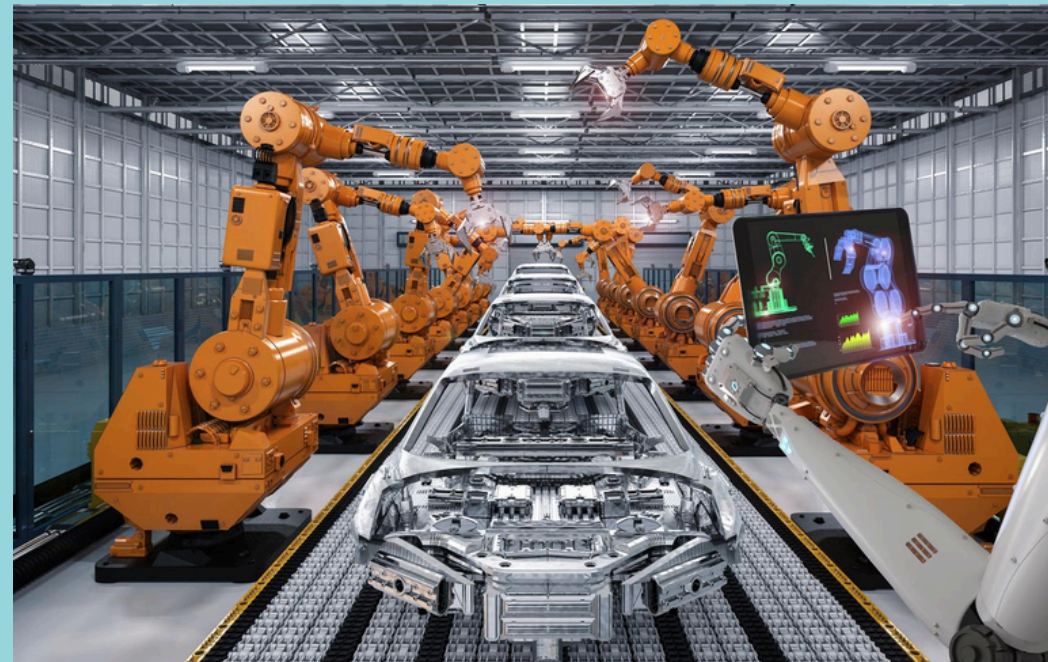Example: Line-following robot, RC car with sensors

🏭 Industrial Robots
Work in factories and industries
Do repetitive tasks like welding, painting, assembling
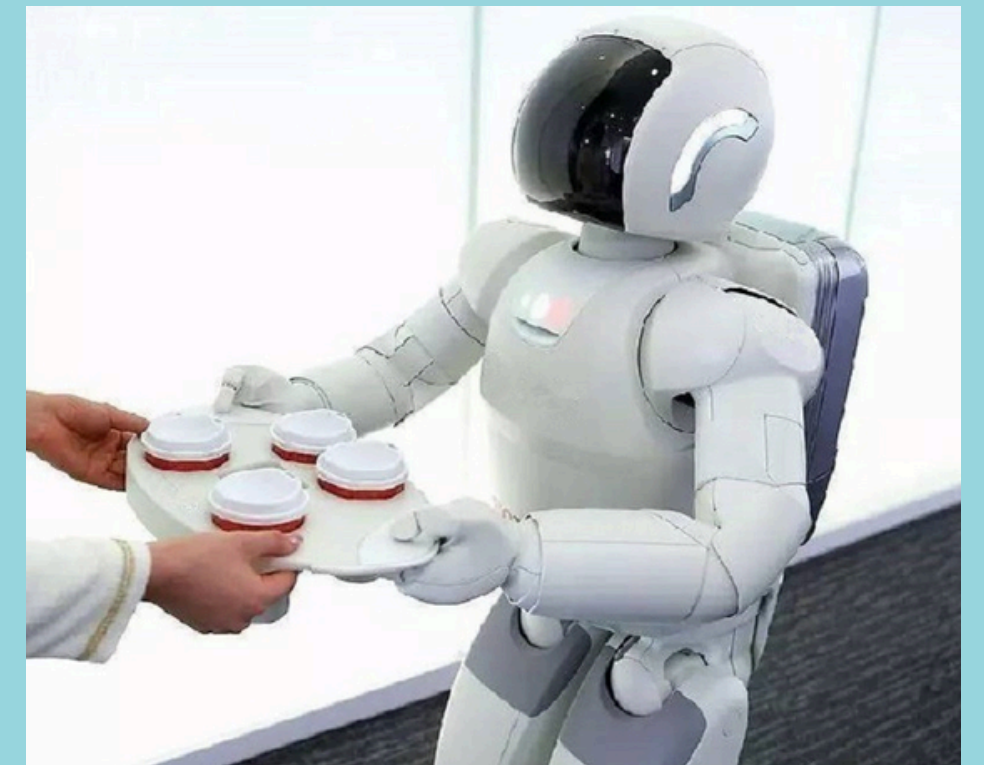🤖 Example: Robotic arms on car manufacturing lines



🏠 Service Robots
Help humans in homes, offices, hospitals
Can clean, assist elderly, deliver items
🧹 Example: Vacuum robot, delivery robot, hospital assistant robot

🧑‍⚕️ **Medical Robots**
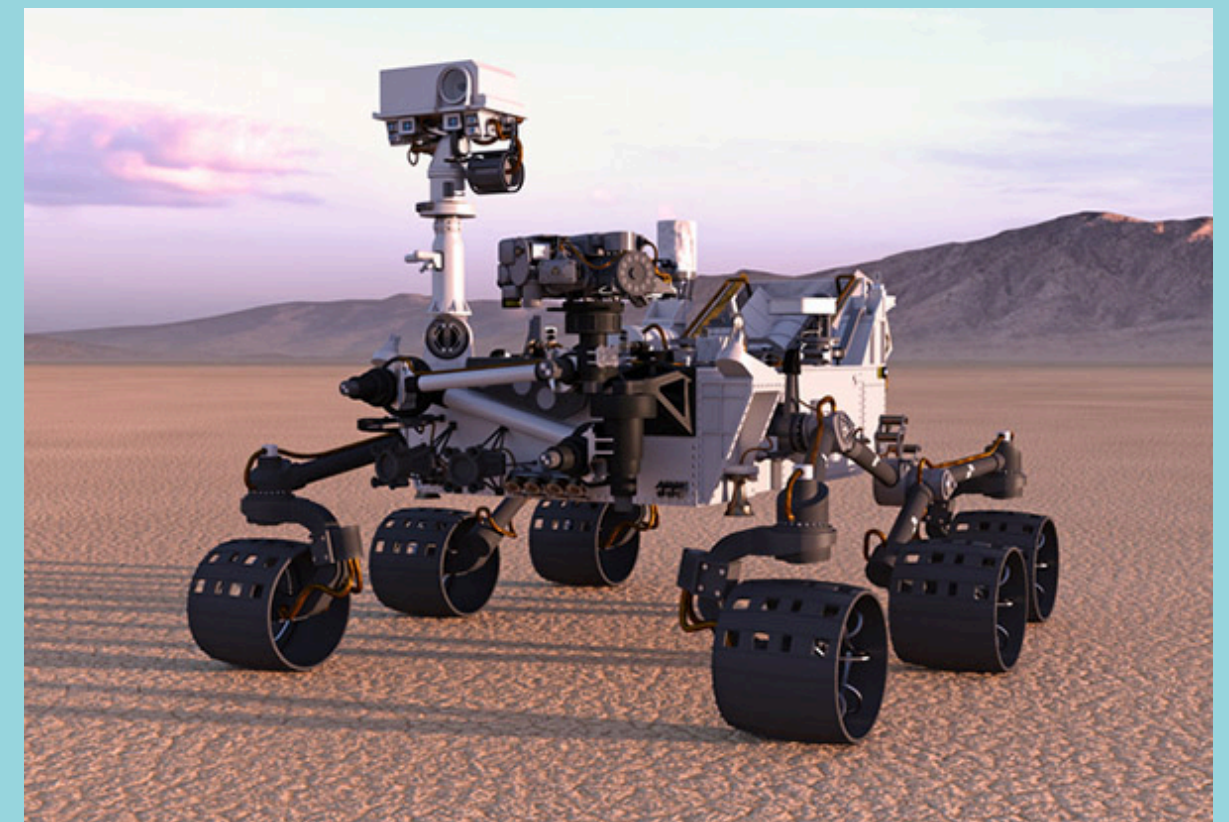Help in surgeries, rehabilitation, or hospital work
🛠️ Example: Surgical robots, prosthetic robotic limbs



🌍 **Exploration Robots**
Used in places humans can't easily go (space, ocean, volcanoes)
🚀 Example: Mars Rover, underwater robot

👦 Humanoid Robots
Robots that look or act like humans
Used in education, entertainment, research
🚶 Example: Dancing robot, robot teacher assistant

# Introduction to the Internet of Things

The **Internet of Things (IoT)** connects everyday devices to the internet, enabling data exchange. This technology enhances convenience and efficiency across multiple sectors, paving the way for a smarter and more interconnected world.

## Definition

IoT refers to devices that communicate over the internet.

## Examples

Common examples include smart thermostats and wearable fitness trackers.

## Benefits

IoT improves efficiency and convenience in daily routines and industries.

# Real–World Applications of Robots

Robots are revolutionizing various industries by enhancing efficiency and accuracy, especially in **agriculture, healthcare**, and **delivery services**. Their integration into smart cities is paving the way for innovative solutions to urban challenges.

## Agriculture

Robots help with planting, harvesting, and monitoring crops for optimal yield.

## Healthcare

Robots assist in surgeries, patient care, and managing hospital logistics effectively.

## Delivery Services

Robots are increasingly used for automated deliveries, ensuring faster service and convenience.

# Summary of Robotics and IoT

In this class, we explored **key concepts** of robotics, various types of robots, and how **IoT** integrates technology into our daily lives, paving the way for future innovations and opportunities in the field.

## Types of Robots

Robots can be classified into several categories based on their application.

## Robotics in IoT

IoT enhances robotic capabilities, allowing for smarter and more efficient systems.

## Learning Outcomes

Students will gain foundational knowledge and skills essential for robotics and IoT.

# What's Next in Robotics?

In our next class, we will dive into **Arduino programming**, learn about various sensors, explore motors, and finally, start building your **first robot**. Get ready for hands-on experiences and exciting challenges!

## Arduino Basics

We'll learn how to program Arduino boards for robotics projects.

## Understanding Sensors

Discover different types of sensors and their applications in robotics.

## Working with Motors

Explore various motors and how they power robotic movements.