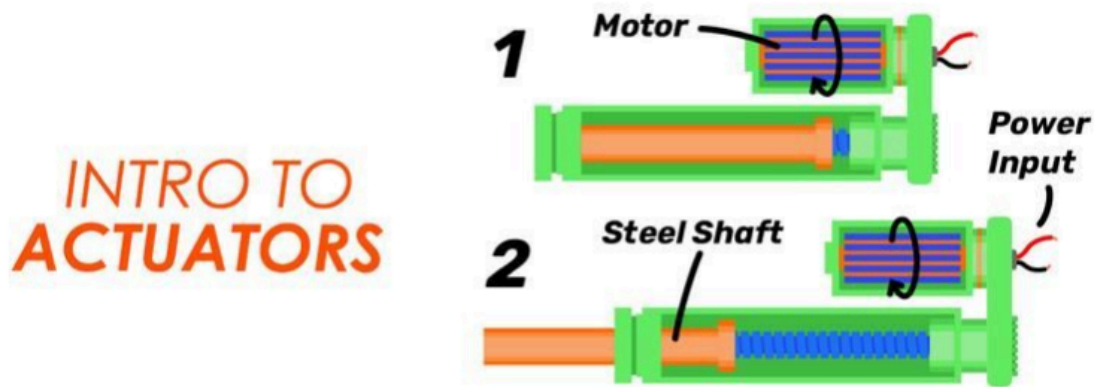


# Actuators and IoT Development Boards

## 1: Title

- Title: [Actuators](#) and IoT Development Boards
  - Instructor Name : Prof Divesh Jadhvani
  - Date : 23/9/2024
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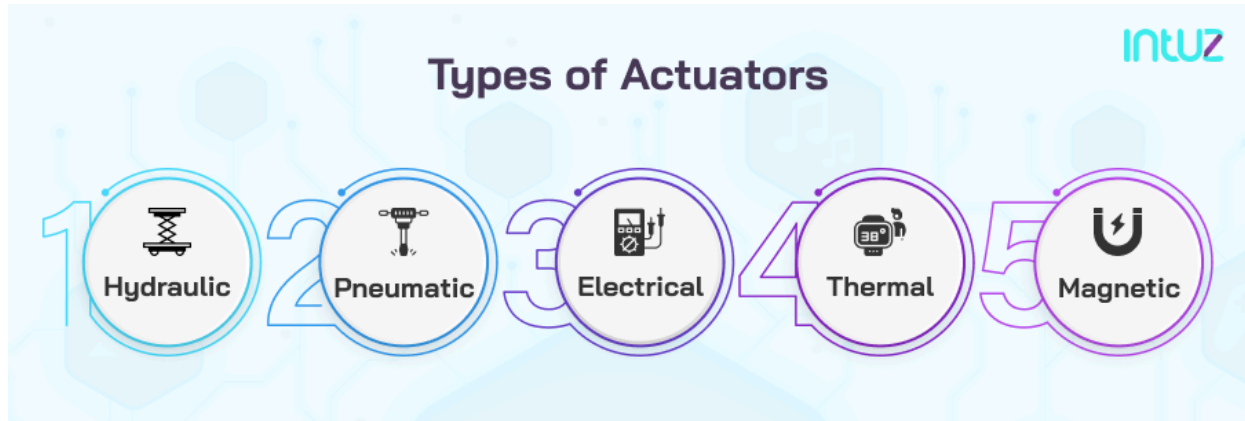
## Part 1: Actuators



## 2: What is an Actuator?

- **Definition:**  
An **actuator** is a device that takes instructions from a system (like a computer or sensor) and makes something **move** or **perform an action** in the real world.
  - **Simple Explanation:**  
Think of an actuator like a robot's arm—it moves and does something when the system tells it to. For example, turning a valve, opening a door, or controlling a fan.
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## 3: Types of Actuators



There are different types of actuators based on what kind of energy they use to perform their action. Let's go through some common types:

### 1. Electric Actuators

- **Definition:** Use electricity to create movement.
- **Real-Life Example:**  
Electric windows in cars. When you press the button, the electric actuator moves the window up or down.

### 2. Hydraulic Actuators

- **Definition:** Use liquid (usually oil or water) to create force and movement.
- **Real-Life Example:**  
Hydraulic lifts in car repair shops. These lifts use liquid pressure to raise the car off the ground for repairs.

### 3. Pneumatic Actuators

- **Definition:** Use compressed air to create movement.
- **Real-Life Example:**  
In factories, pneumatic actuators are used to move parts on an assembly line, like pushing items into place with bursts of air.

### 4. Thermal Actuators

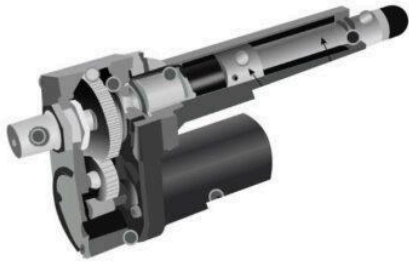
- **Definition:** Use heat to create movement.
- **Real-Life Example:**  
Thermostats in heating systems use thermal actuators to open or close vents when the temperature reaches a certain point.

### 5. Magnetic Actuators

- **Definition:** Use magnetic fields to create movement by attracting or repelling parts inside the actuator.
- **Real-Life Example:**  
**Magnetic door locks** in office buildings or hotels. These locks use magnetic actuators to secure doors, allowing them to open or close when an electric signal is sent.

# Actuators Source of Energy

## Electric



## Pneumatic

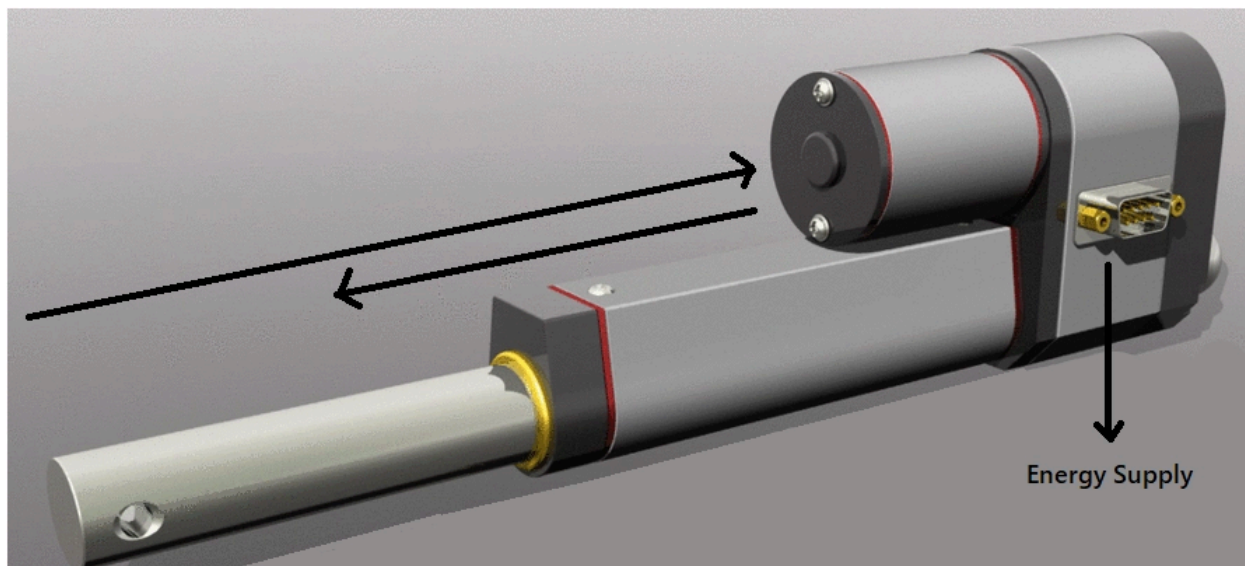


## Hydraulic



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## 4: Electric Actuators in IoT

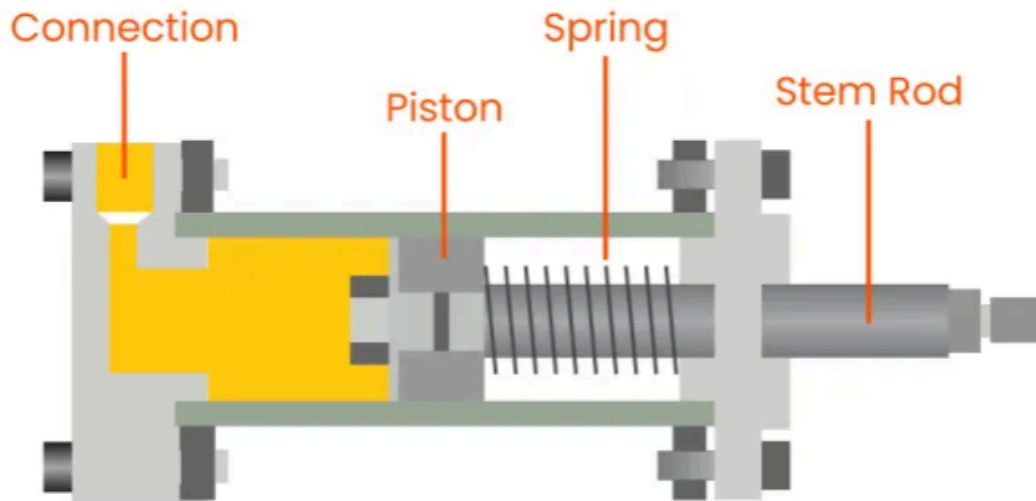


- **Explanation:**  
Electric actuators are commonly used in IoT devices because they can be easily controlled by sensors and systems that rely on electricity, like smart home devices.
- **Real-Life Example:**  
**Smart Blinds:** In a smart home, electric actuators are used to open or close window

blinds based on light sensors or voice commands from devices like Amazon Alexa or Google Home.

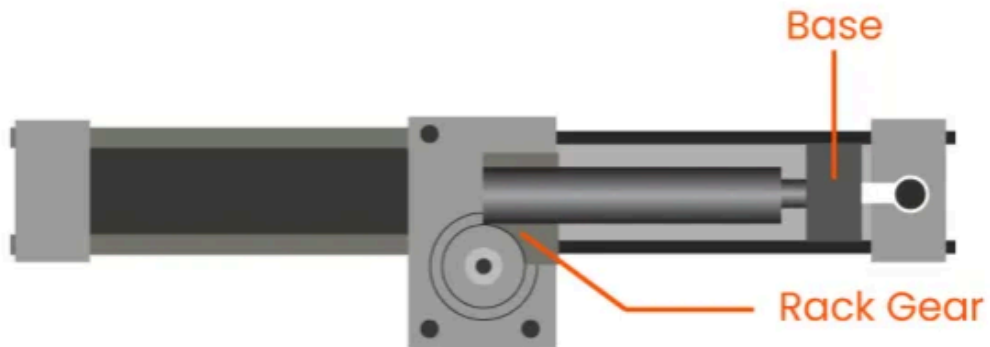
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## 5: Hydraulic Actuators in Industry



- **Explanation:**  
Hydraulic actuators are often used in industrial applications where a lot of force is needed.
  - **Real-Life Example:**  
**Construction Equipment:** Machines like bulldozers and excavators use hydraulic actuators to move their large arms and scoops. Sensors can be added to these machines to create IoT systems that monitor their performance and maintenance needs.
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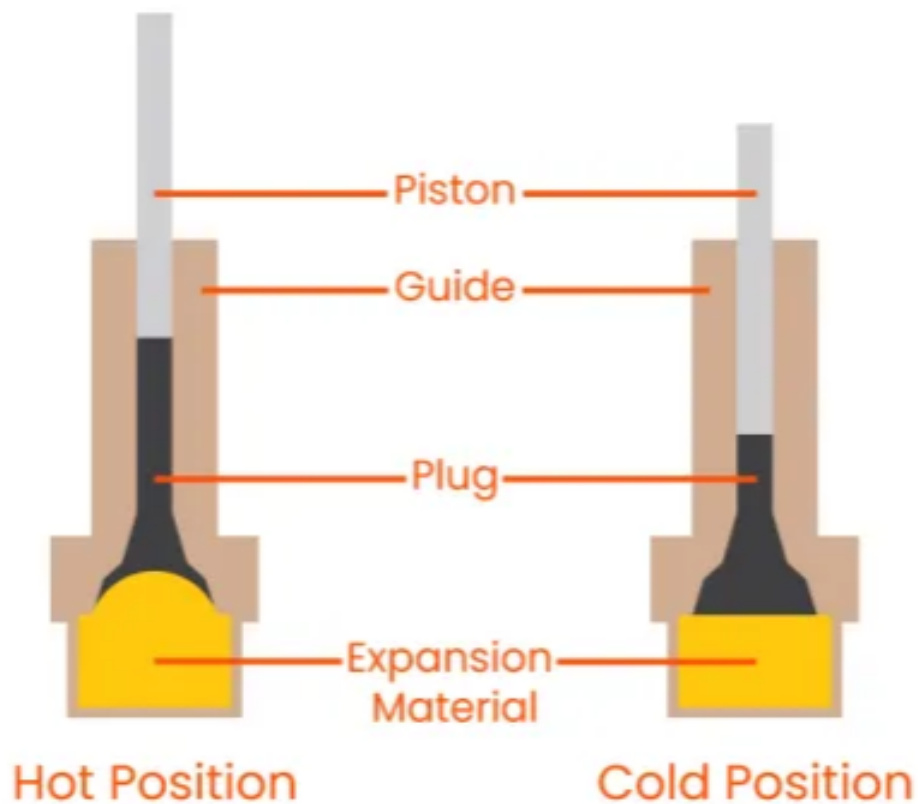
## 6: Pneumatic Actuators in Factories



- **Explanation:**  
Pneumatic actuators are fast and strong, making them ideal for use in factories with IoT systems.
- **Real-Life Example:**  
**Automated Production Lines:** Factories use pneumatic actuators to push items along the production line. IoT sensors can track how many items have been produced, and the actuators will adjust speed or force based on real-time data.

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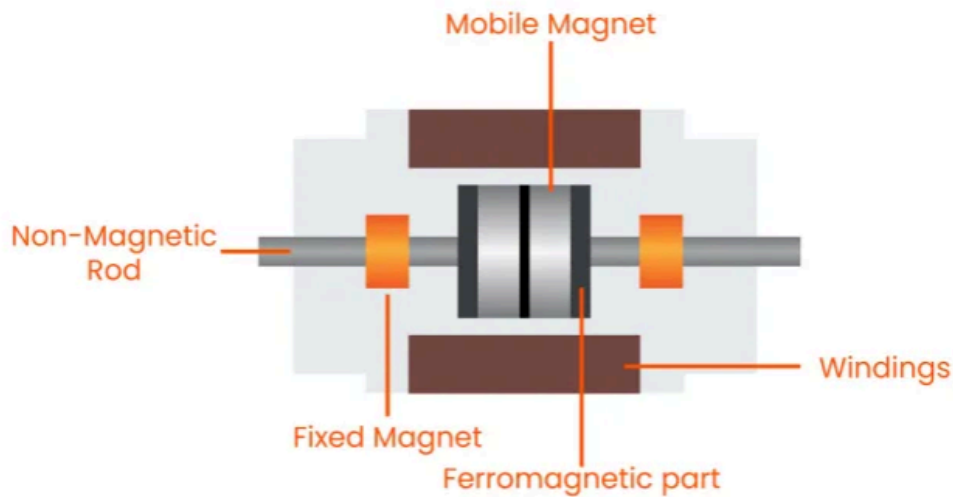
## 7: Thermal Actuators in Home Heating



- **Explanation:**  
Thermal actuators are great for controlling temperature and are used in smart heating systems.
- **Real-Life Example:**  
**Smart Thermostats:** In modern homes, smart thermostats use sensors to measure the temperature in each room. If a room gets too hot, the system sends a signal to the thermal actuator to open a vent, letting in cooler air.

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## 8: Magnetic Actuators in Smart Security

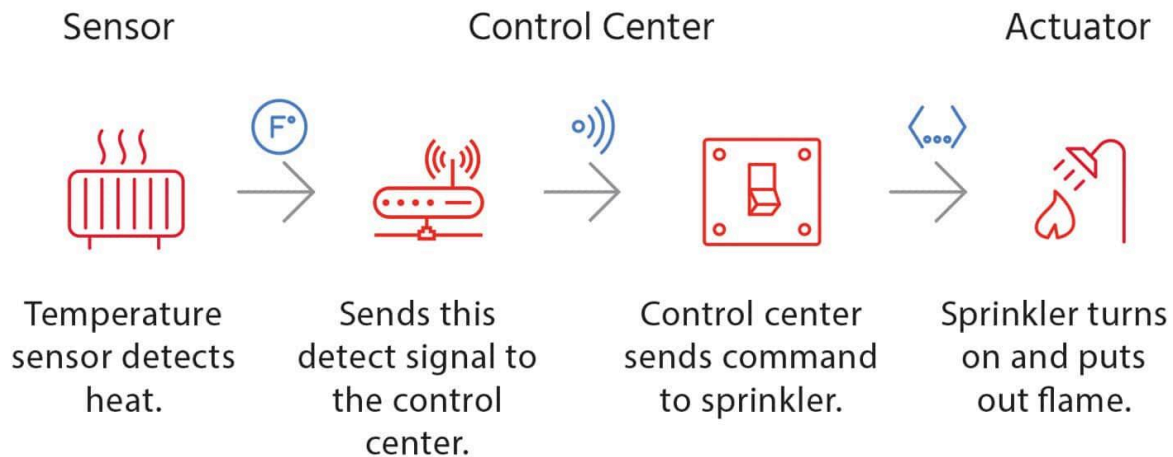


- **Explanation:**  
Magnetic actuators are commonly used in security systems, where locking and unlocking need to be both fast and reliable.
  - **Real-Life Example:**  
**Smart Magnetic Locks:** In smart offices or hotels, magnetic actuators control door locks. A keycard or mobile app sends a signal to the lock's actuator, either magnetically locking or unlocking the door. Sensors can even send alerts if a door is forced open.
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## 9: Actuators in Modern IoT Applications

- **Explanation:**  
Actuators are essential in IoT because they allow systems to interact with the physical world.
  - **Real-Life Examples:**
    1. **Smart Locks:** Actuators are used to automatically lock or unlock doors when sensors detect that the owner is nearby or when a phone app sends a command.
    2. **Self-Driving Cars:** Actuators control steering, braking, and acceleration based on sensor data from the car's surroundings, making real-time decisions to ensure safe driving.
- 

## 10: How Actuators and Sensors Work Together



- **Explanation:**  
In IoT systems, sensors collect data (like temperature or movement), and actuators act on this data to perform physical tasks. They work together like a **cause and effect** system.
- **Real-Life Example:**  
In **smart agriculture**, sensors monitor soil moisture levels. When the soil becomes too dry, the system sends a signal to the actuator to turn on a water pump, watering the plants automatically.

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## Summary of Actuators

- **Key Points:**
  - Actuators turn electrical signals into real-world actions.
  - They come in different types: electric, hydraulic, pneumatic, and thermal.
  - Actuators are widely used in industries like **smart homes**, **factories**, and **transportation**.

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## Part 2: IoT Development Boards

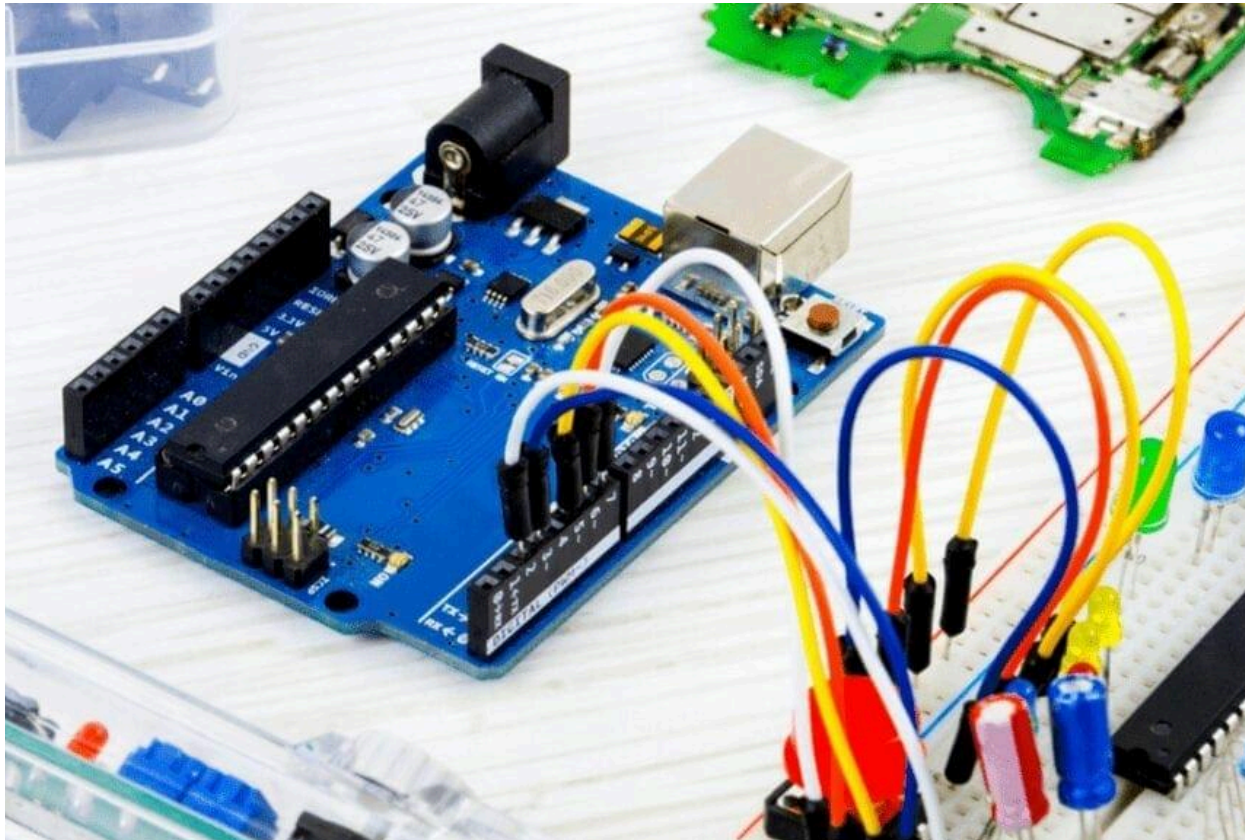
### 11: What are IoT Development Boards?

- **Definition:**  
An **IoT development board** is a small circuit board that includes a microcontroller (a tiny computer) and other components, making it easier to build IoT devices.



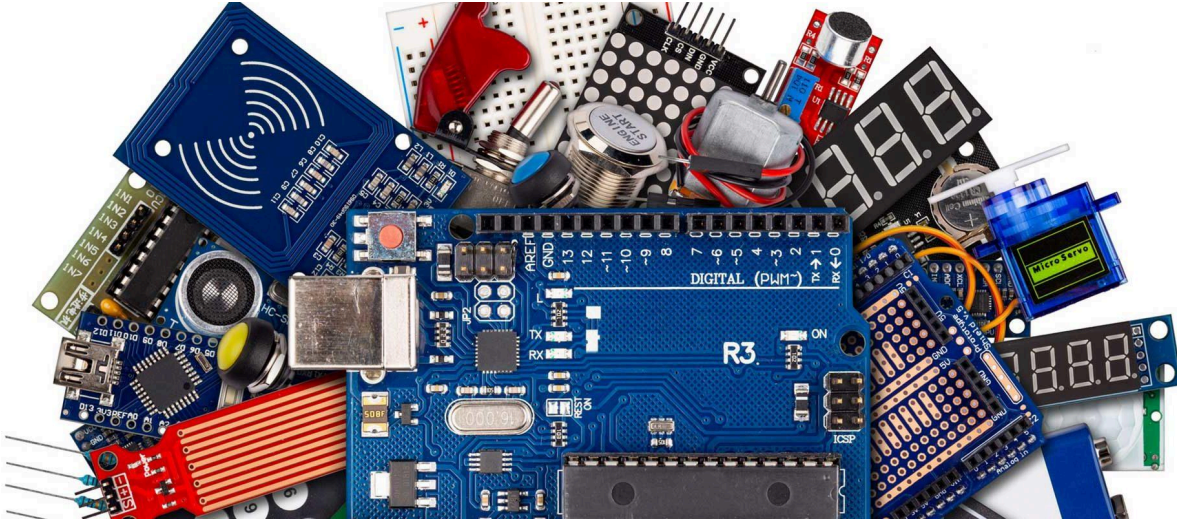
- **Real-Life Example:**  
Think of it like the "brain" of your smart home devices, helping them understand commands and control sensors or actuators.
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## 12: Overview of Arduino



- **Explanation:**  
**Arduino** is one of the most popular IoT development boards. It's beginner-friendly, easy to use, and can be connected to different sensors and actuators to build IoT projects.
  - **How It Works:**  
You can connect sensors to the Arduino board to collect data (e.g., temperature, light) and use it to control actuators (e.g., motors, lights).
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## 13: Applications of Arduino

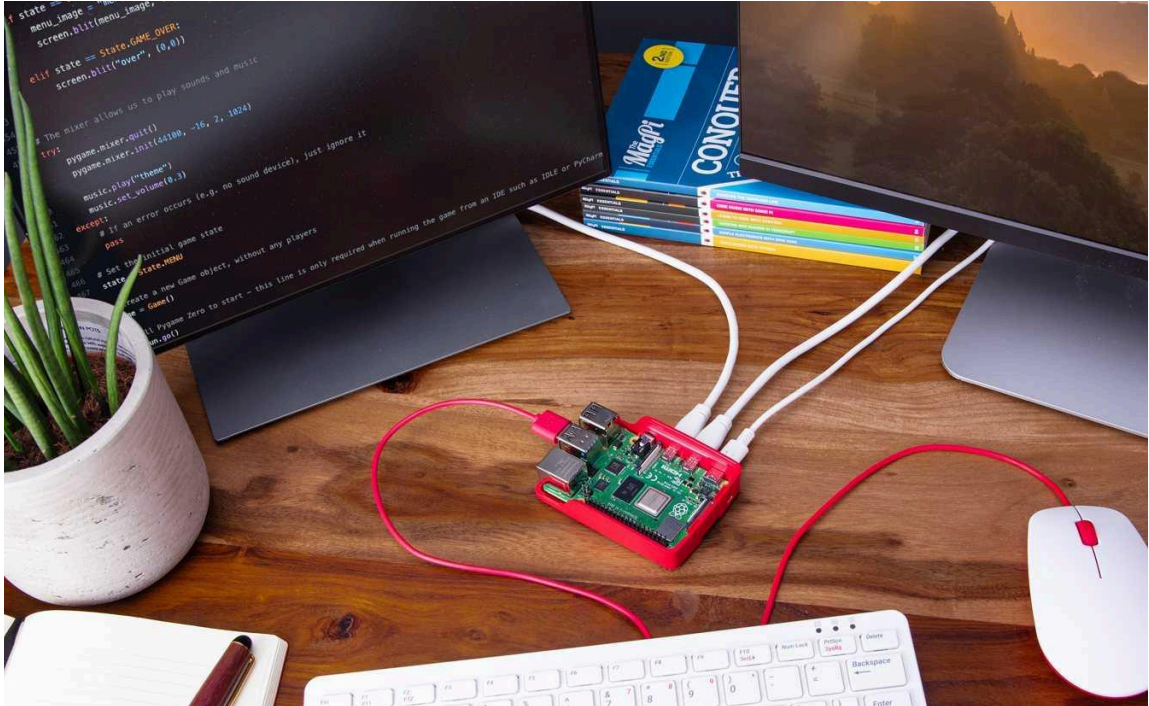


1. **Smart Home Systems:**  
You can use Arduino to build systems that control lights, doors, or appliances based on sensor data.
2. **Weather Stations:**  
By connecting temperature and humidity sensors to an Arduino, you can create a weather station that collects data and uploads it to the internet.
3. **Health Monitoring Devices:**  
Arduino boards can be used in wearable devices to monitor heart rate or activity levels, sending the data to a phone app for real-time health tracking.

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## 14: Other Popular IoT Development Boards

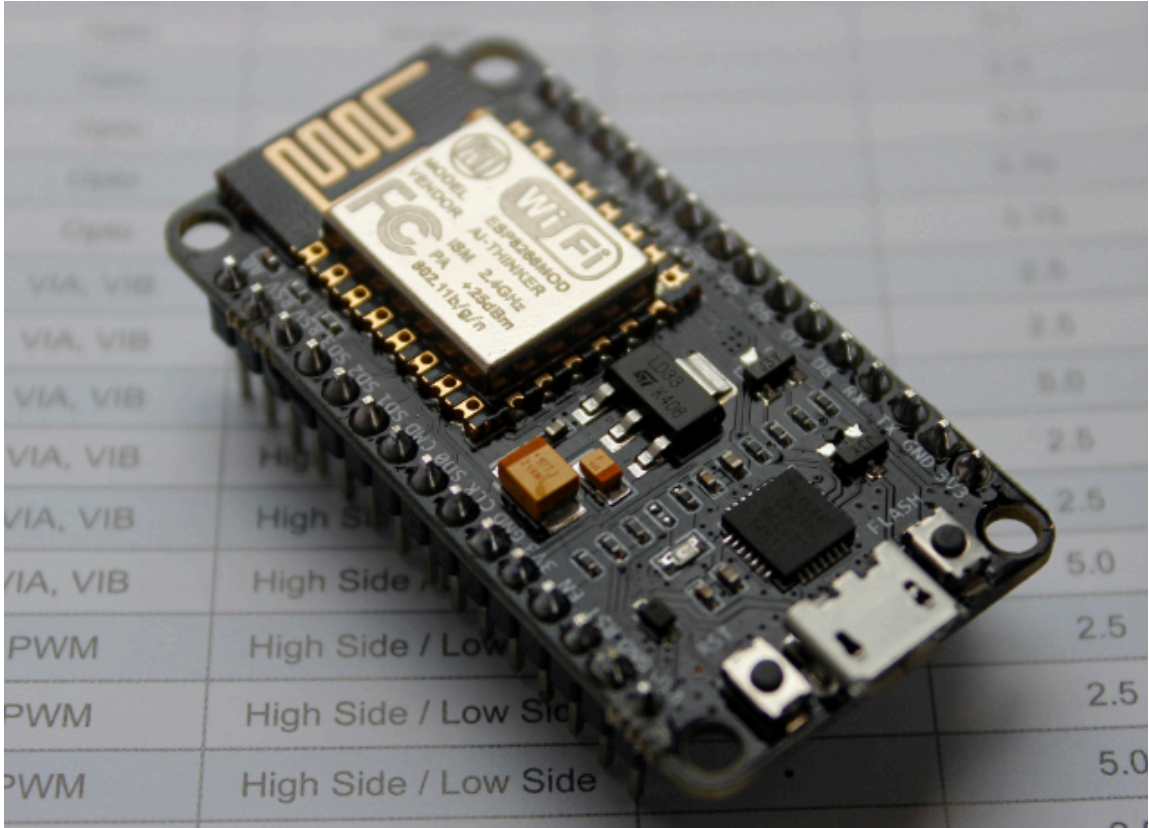
1. **Raspberry Pi:**



More powerful than Arduino, often used for projects that need advanced computing power, like facial recognition or video processing.

## 2. **ESP8266:**





A low-cost board that has built-in Wi-Fi, making it ideal for IoT projects where devices need to communicate over the internet.

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## 15: Choosing the Right IoT Board

- **Factors to Consider:**
  1. **Project Complexity:** For simple tasks, use Arduino. For more advanced projects, Raspberry Pi might be better.
  2. **Connectivity Needs:** If you need Wi-Fi or Bluetooth, choose a board like **ESP8266** or **NodeMCU**.

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## 16: Conclusion

- **Key Takeaways:**
  - Actuators and sensors are the building blocks of IoT systems, allowing devices to interact with the physical world.

- IoT development boards like Arduino and Raspberry Pi make it easy to build smart systems by connecting sensors and actuators.