



Introduction to Physical Computing

Isuru Nanayakkara
nhp@ucsc.cmb.ac.lk



01

What is PC?

02

Why PC?

03

Overview

04

Introduction to Microcontrollers

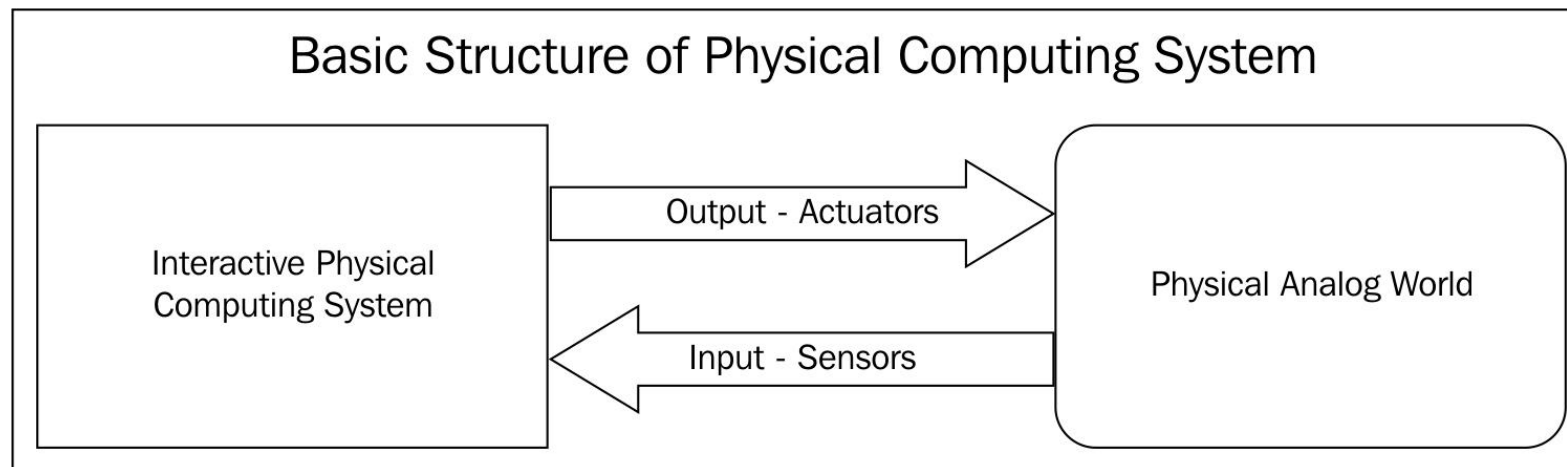


01

What is PC?

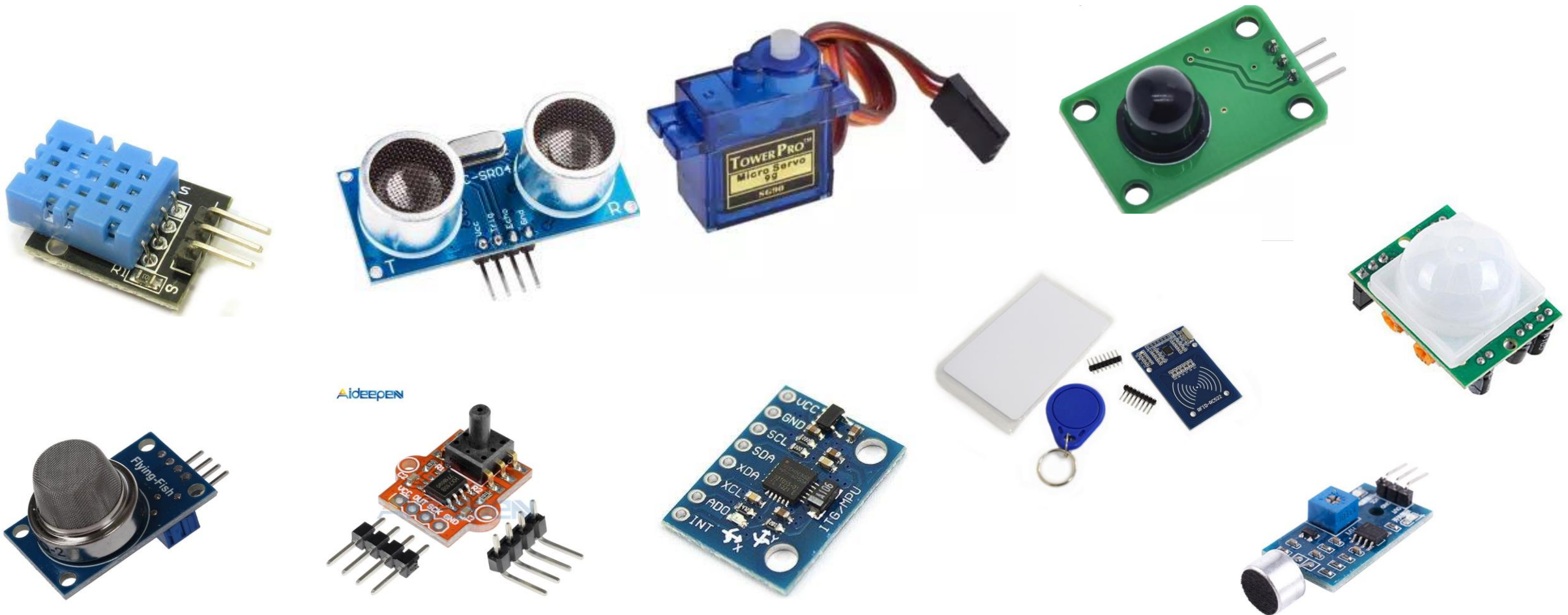
What is PC?

- “Physical computing means building **interactive physical systems** by the use of **software** and **hardware** that can **sense and respond** to the **analog world** ... “
- ... In practical use, the term most often describes handmade art, design or DIY hobby projects that use sensors and microcontrollers to translate analog input to a software system, and/or control electro-mechanical devices such as motors, servos, lighting or other hardware.” (Wikipedia)
- Physical Computing is how computers can communicate with humans and the environment
Building a digital system that utilizes **sensors** and **actuators** to interact with the physical world
An Interactive Physical System



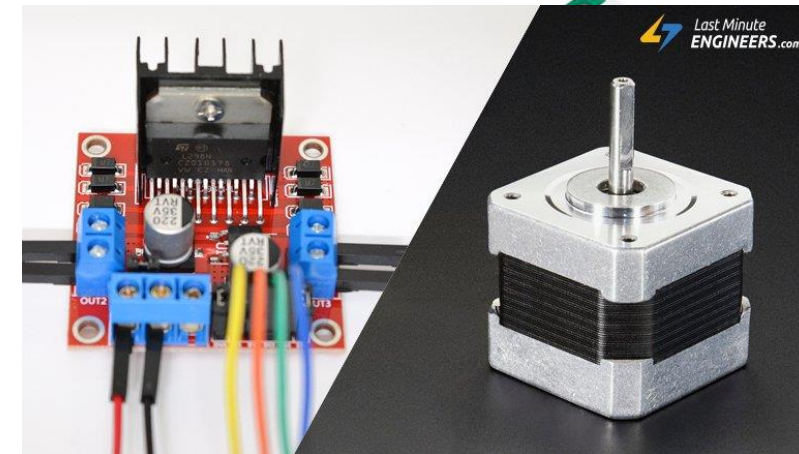
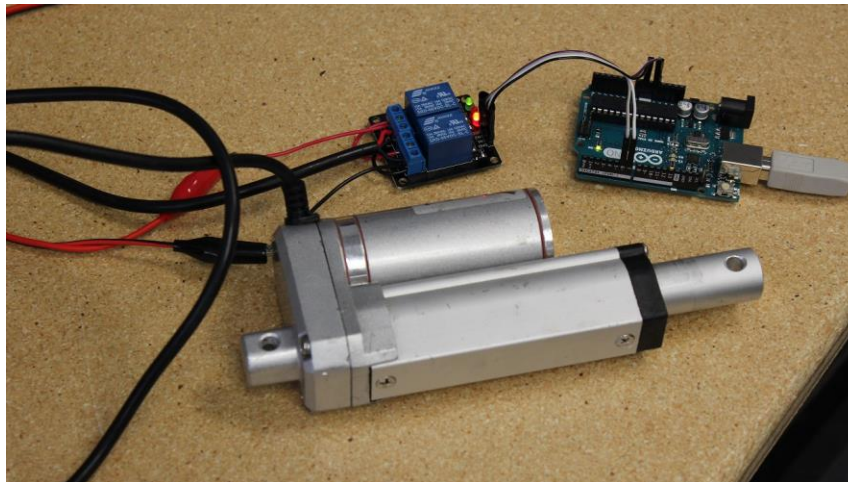
Sensors vs Actuators

- Sensor – device that **detects events or changes** in the **environment**
- Actuator – a component of a machine that is **responsible for moving and Controlling mechanism**



Sensors vs Actuators

- Sensor – device that **detects events or changes** in the **environment**
- Actuator – a component of a machine that is **responsible for moving and Controlling mechanism**



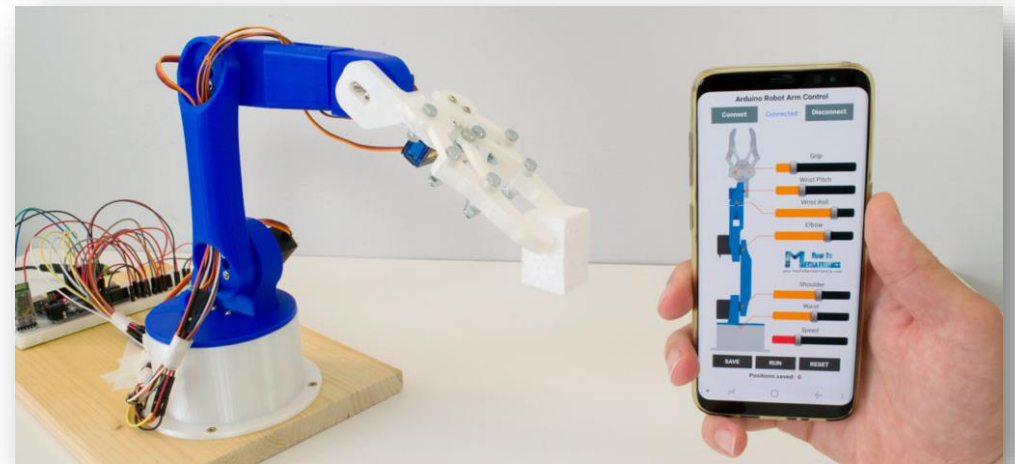
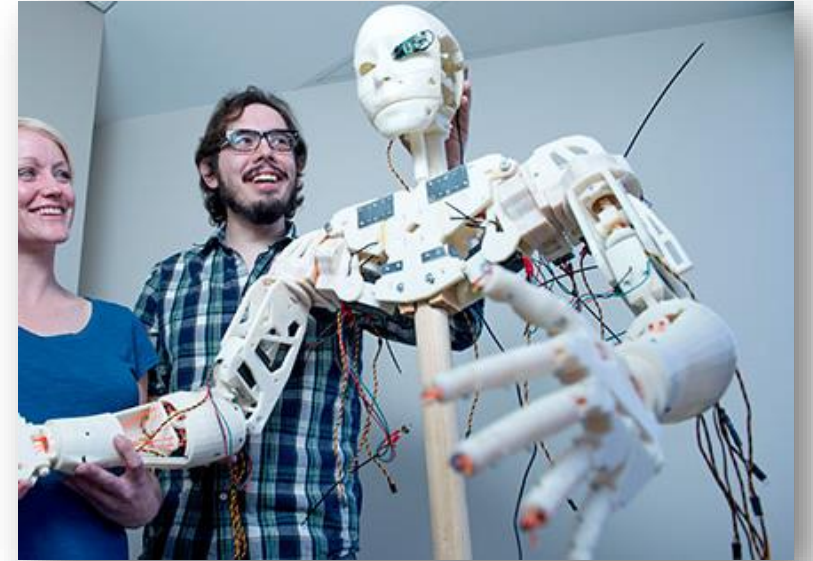
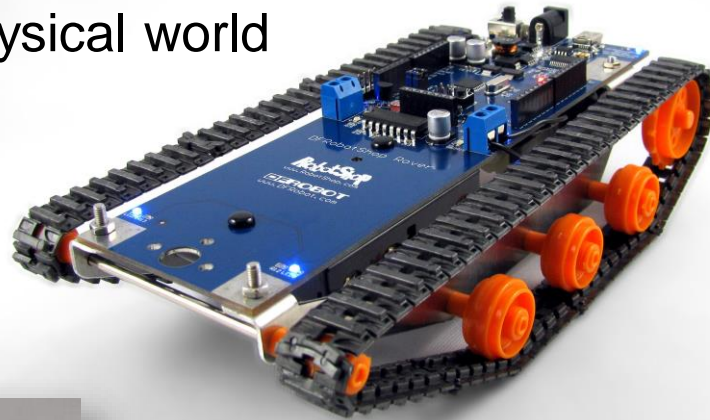


02

Why PC?

Why PC?

- Tangible products for real physical world
- Interactive objects
- Imagination is the limit





Need more inspiration?





03

Overview



Overview



- Microcontrollers
 - Arduino
 - Components
 - Boards
- C / C++
 - Arduino IDE
 - Tinkercad
- Sensors and actuators
 - PWM
 - ADC
- Communication
 - UART, I2C, SPI and 1-wire
 - Wireless communication
- IoT
 - IoT enabled devices and CoT

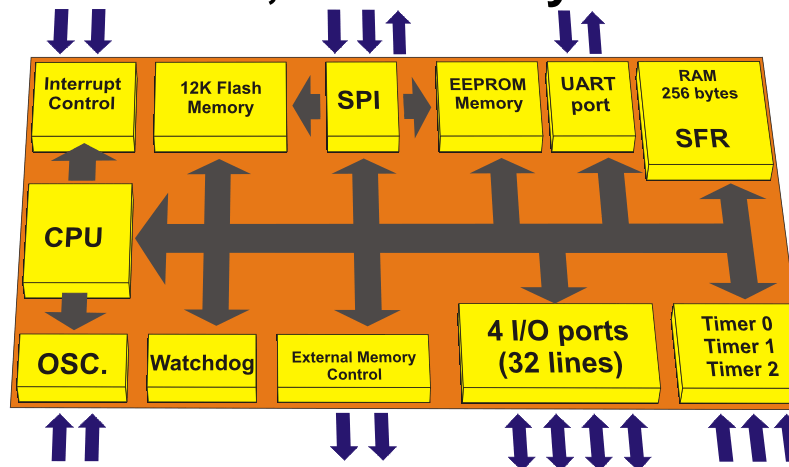
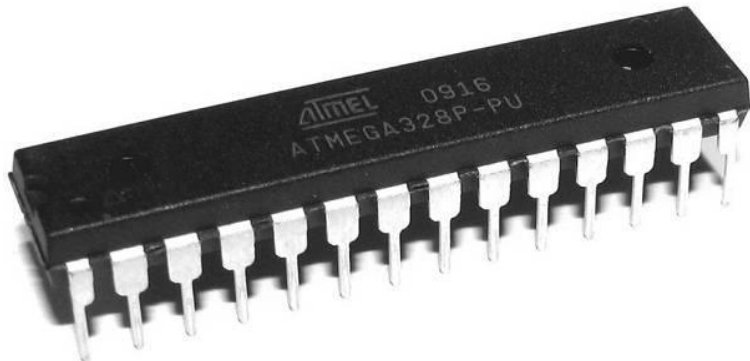
A glowing blue microcontroller chip is centered on a dark blue circuit board. Numerous glowing blue lines, resembling circuit traces, radiate from the chip and extend across the frame. The background is a deep blue with subtle patterns of light and dark blue lines, creating a high-tech, digital atmosphere.

04

Introduction to Microcontrollers

Introduction to Microcontrollers

- What is a microprocessor?
 - Represents a central processing unit (CPU) performs **arithmetic and logical operations** according to a pre defined set of instructions.
 - Contains the Arithmetic and Logic Unit (**ALU**), Control Unit (**CU**) and **working registers**.
 - **Requires** a combination of other hardware like **memory, timer unit, interrupt controller**, etc.
- What is a microcontroller?
 - A microcontroller **contains all the necessary functional blocks** for independent working **CPU, RAM**, special and **general purpose register arrays**, on chip **ROM/FLASH** memory for program storage, **timer and interrupt control units**, and **dedicated I/O ports**.
 - Other advantages: **cheap, cost effective, and readily available in the market**.



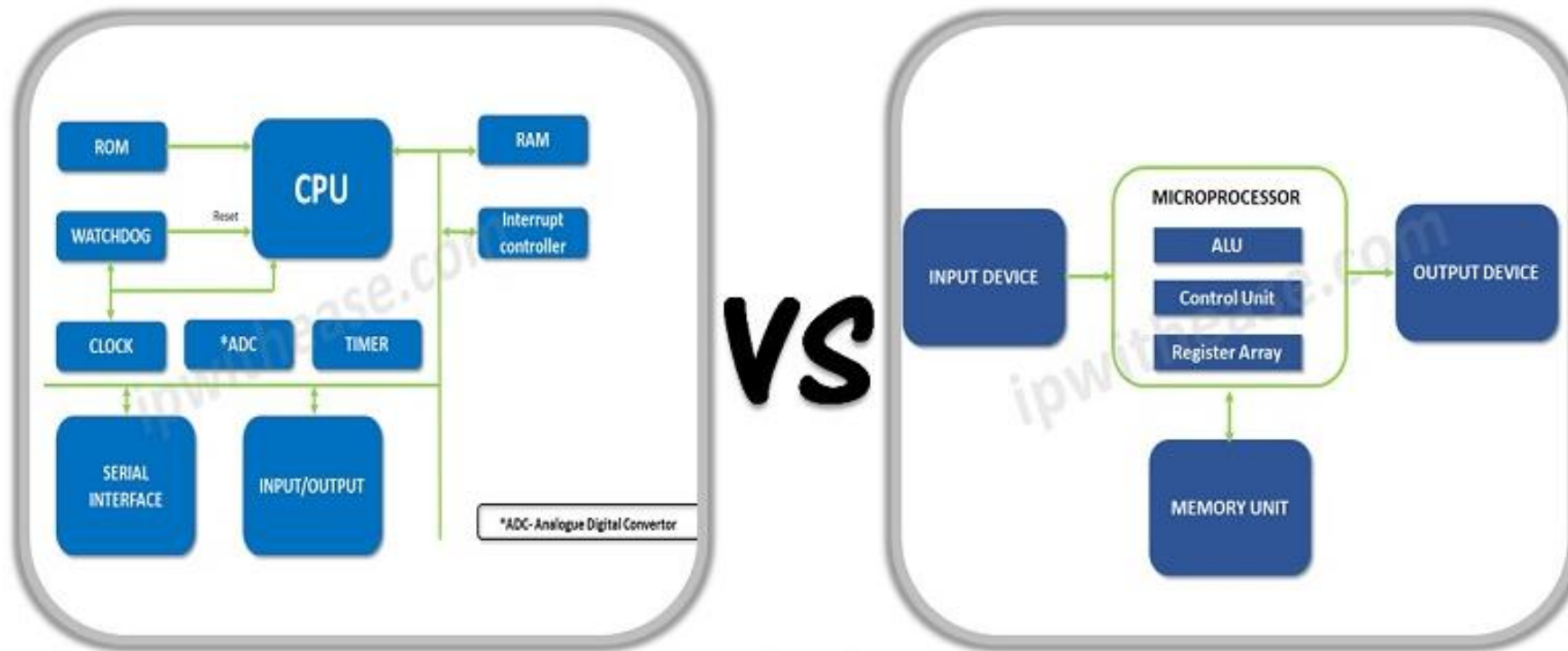
Microcontrollers vs Microprocessors

➤ Microcontroller vs Microprocessor

Summary	Microprocessor	Microcontroller
Applications	Advanced data processing, video, computer vision, personal computers, fast communications, multi-core computation.	Embedded devices, control systems, smartphones, consumer electronics.
Processing Power	Higher	Lower
Memory	External - Flexible	Internal – Limited Size
Power Consumption	Higher	Lower
Size	Larger	Smaller
Price	Expensive	Cheaper
I/O	Need external peripherals with I/O pins	Programmable digital and analog I/O pins

Microcontrollers vs Microprocessors

➤ Microcontroller vs Microprocessor



Microcontrollers in day-to-day

