Ministry of Higher Education and Scientific Research
العلمي البحث و العالي التعليم وزارة

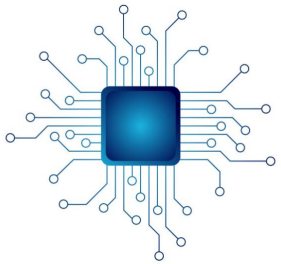
BADJI MOKHTAR-ANNABA UNIVERSITY
UNIVERSITE BADJI MOKHTAR-ANNABA

جامعة باجي مختار-عنابة

Faculty of technology
Electronics departement
Embedded Computing Systems course
Teaching method : Distance learning

Course 1: About the course

Recap



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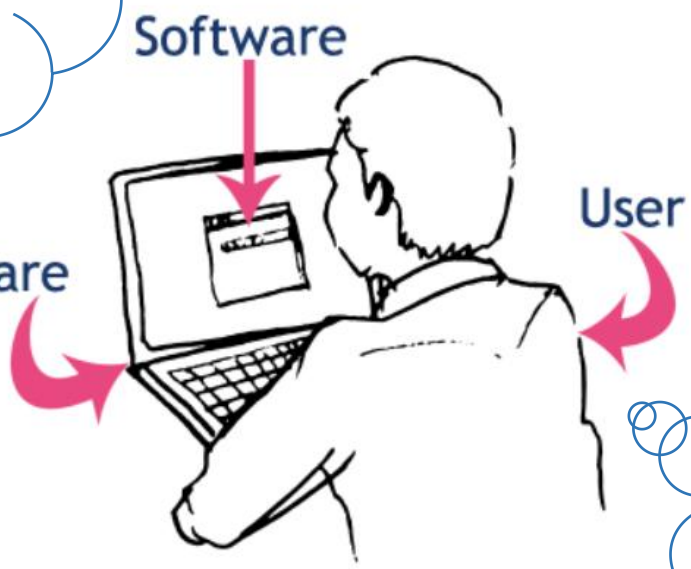
EAD3, DD 3

Promotion : 2025/2026

- **Basic Components of a Computer System:**

the programs/instructions that control the hardwarets.

the physical components



the person who interacts with the system by giving input and receiving output.

✓ These three elements form the foundation of both general-purpose computers and embedded systems.

What are Embedded Systems?

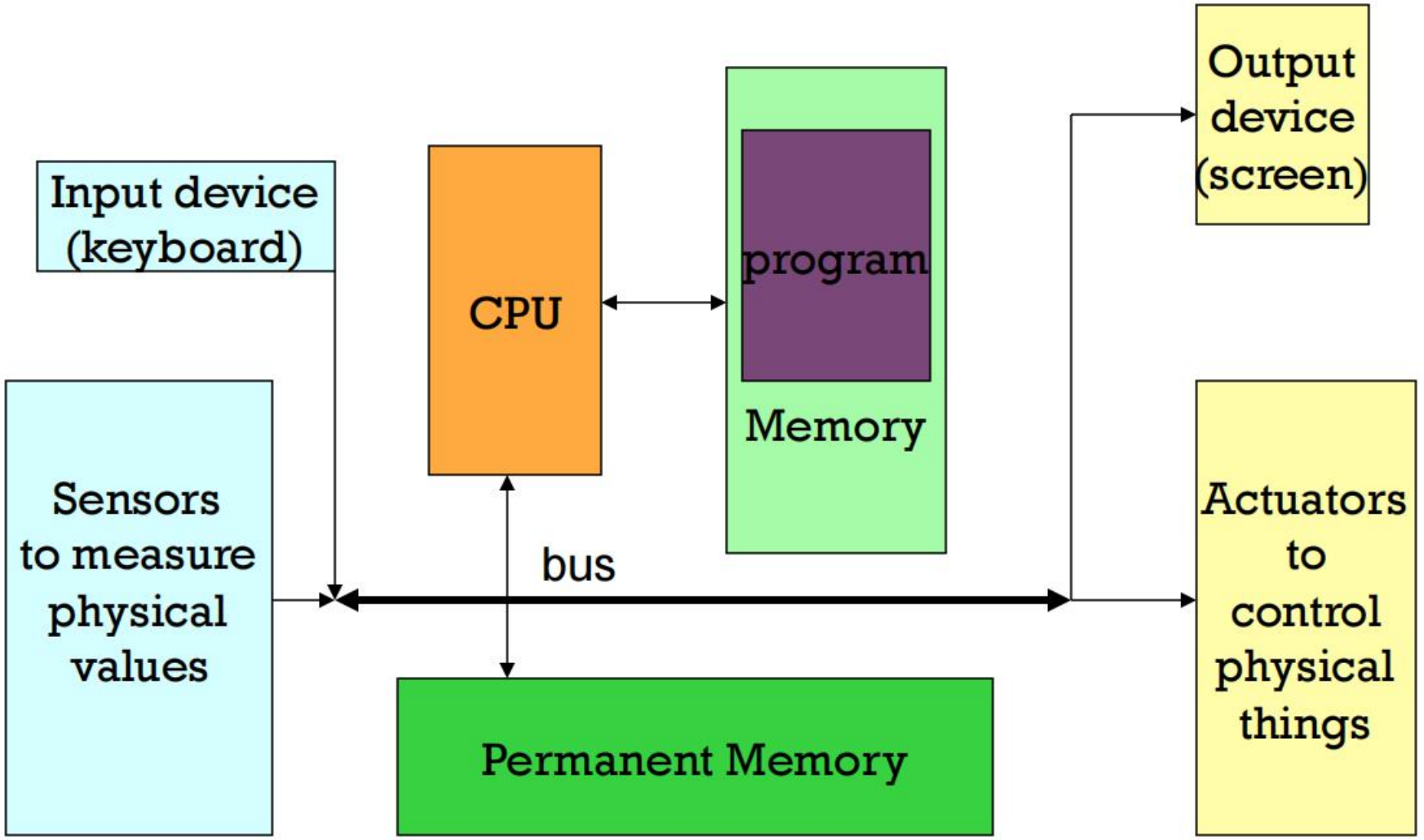
Embedded system doesn’t just refer to a system, it is a combination of both hardware and software that would allow you to program it. Thus it can be used for a specific function or functions within a larger system.

Definition of Embedded systems are computers designed for a specific purpose. Instead of doing many tasks like a general computer, they usually perform only one or a few dedicated functions.

They combine hardware (like microprocessors, memory chips, input/output devices such as screens or keyboards, and sometimes special chips like DSPs) with software (such as real-time operating systems to manage tasks, or firmware stored in memory). to perform a specific function. It is often a part of a larger system. Depending on the design, an embedded system may be programmable (allowing updates or changes) or have a fixed functionality (performing the same task permanently).

These systems can also connect to the outside world through sensors (to receive information) and actuators (to act on the environment), which allows them to control physical processes

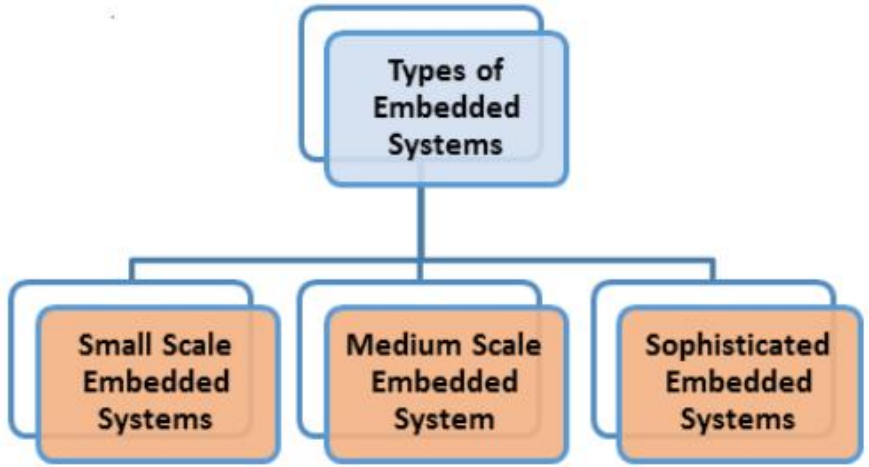
Structure of an Embedded System

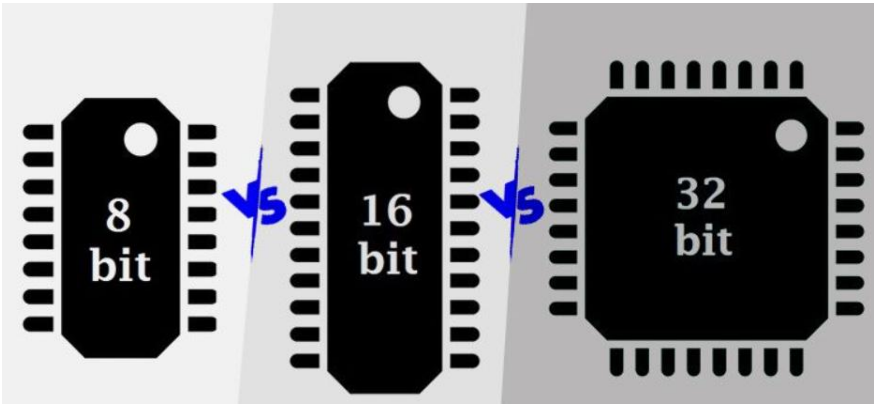


Types of Embedded Systems

There are 3 main types of Embedded System:

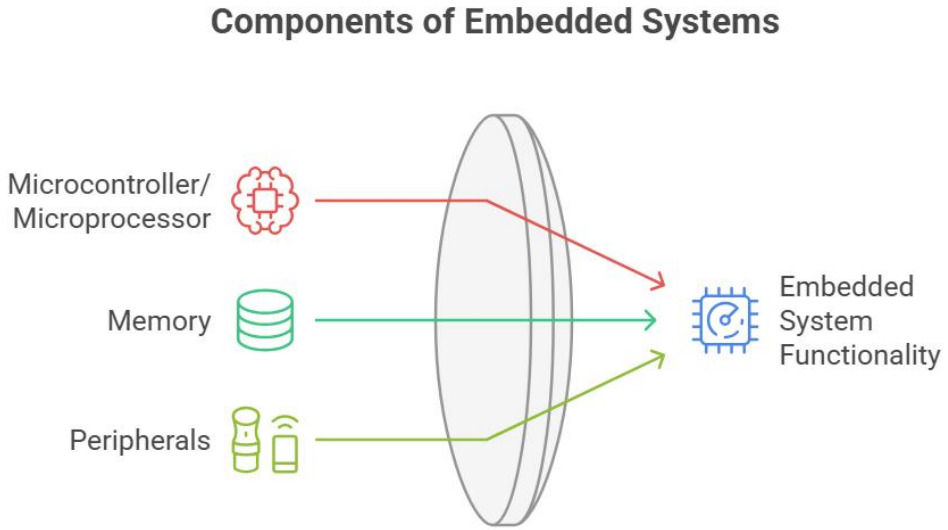
- **Small scale**: Designed with 8 or 16-bit microcontroller, able to operate with a battery.
- **Medium scale**: Designed with 16 or 32-bit microcontrollers, offers software and hardware complexities. C or Java etc. are used to develop.
- **Sophisticated**: Typically has lots of software and hardware complexities, would require processors to do so. Other components or software and hardware may be combined in the latter stage of development.





➢ Components of Embedded Systems

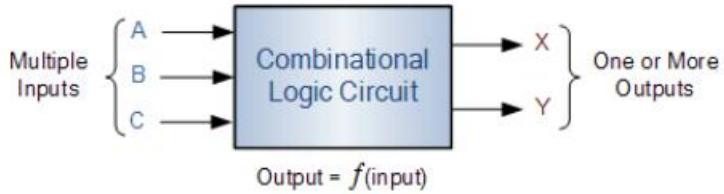
Embedded systems typically consist of three main components:



- **Microcontroller or Microprocessor:** This is the brain of the system, responsible for executing the software instructions. A microcontroller is a compact integrated circuit designed to govern a specific operation in an embedded system.
- **Memory:** Memory in embedded systems is used to store code and data. It can be read-only memory (ROM) for permanent storage and random-access memory (RAM) for temporary storage.
- **Peripherals:** These are the input/output devices that allow the embedded system to interact with the external environment. Peripherals can include sensors, actuators, communication modules, and user interfaces.

❖ Combinational Logic

Combinational logic is a type of digital circuit where the output depends only on the current inputs:

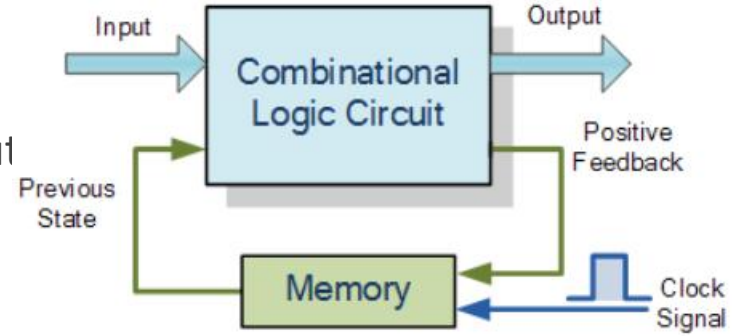


- ✓ No memory
- ✓ Output changes immediately when inputs change
- ✓ Used for simple operations like calculations and selections

Exemple: Multiplexers, Decoders

❖ Sequential Logic

Sequential logic is a type of digital circuit where the output depends on current input and past states (memory), Often works with a clock signal and used for systems that change over time



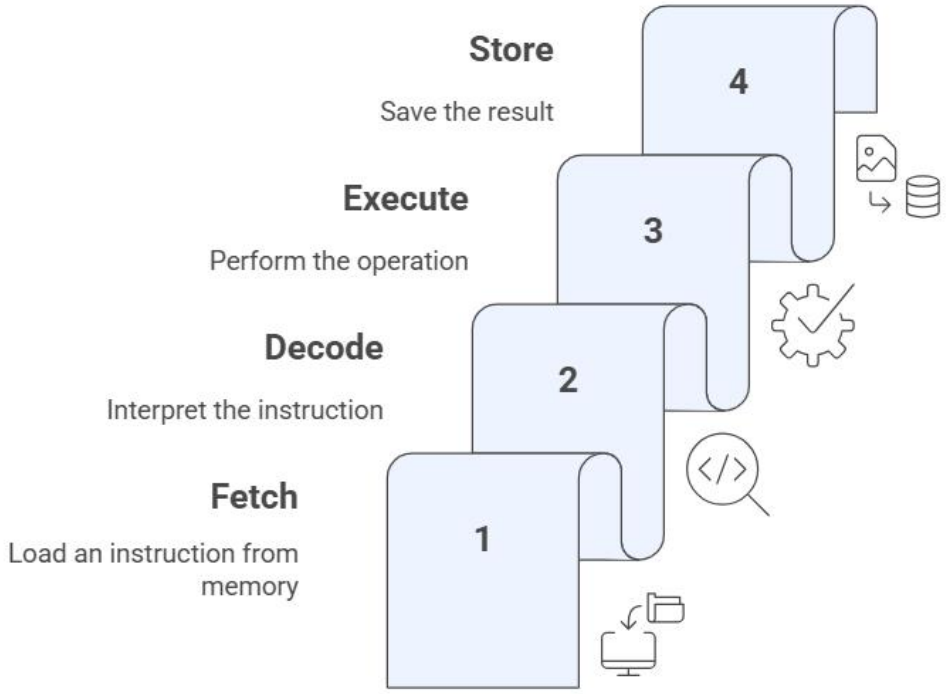
Exemple: Counters, Registers

Why Sequential Logic Matters for Microprocessors (MP)

→ **A microprocessor** is a sequential system

It works step by step under the control of a clock, using registers, counters, and memory elements to stay synchronized.

The operation cycle is:



Without sequential logic, a microprocessor could not carry out instructions in order or ensure correct timing between operations.

❖ Data Units – Basic Concepts

Computers work with data in the form of bits (0s and 1s). Larger units are built from bits.

1. Bit (b) → The smallest unit of data, value is either **0 (low/off)** or **1 (high/on)**.

- **Example:** Light switch (ON = 1, OFF = 0).

2. Nibble → A group of 4 bits.

Range: 0000 (0 in decimal) to 1111 (15 in decimal).

Used often in hexadecimal representation.

- **Example:**

1010 (binary) = 10 (Decimal) = A (Hex).

3. Byte (B) → A group of 8 bits = 2 nibbles.

Most common unit in computers, Bytes are the dominant unit of measurement for calculating quantities of data or storage capacities. abbreviated with "B". Unlike the bit, which can only represent one of two states, the byte can represent 256 (2^8) states (0–255).

- **Example:**

01000001 = 65 (Decimal)= Letter "A".

4. Word → A group of 16, 32, or 64 bits, depending on the processor.

The word size determines how much data the processor can handle at once.

- **Example:**

32-bit CPU → Word = 32 bits.

64-bit CPU → Word = 64 bits.

5. Storage Units → Since bytes are small, bigger multiples are used:

→ 1 Kilobyte (KB) = 1024 Bytes

→ 1 Megabyte (MB) = 1024 KB

→ 1 Gigabyte (GB) = 1024 MB

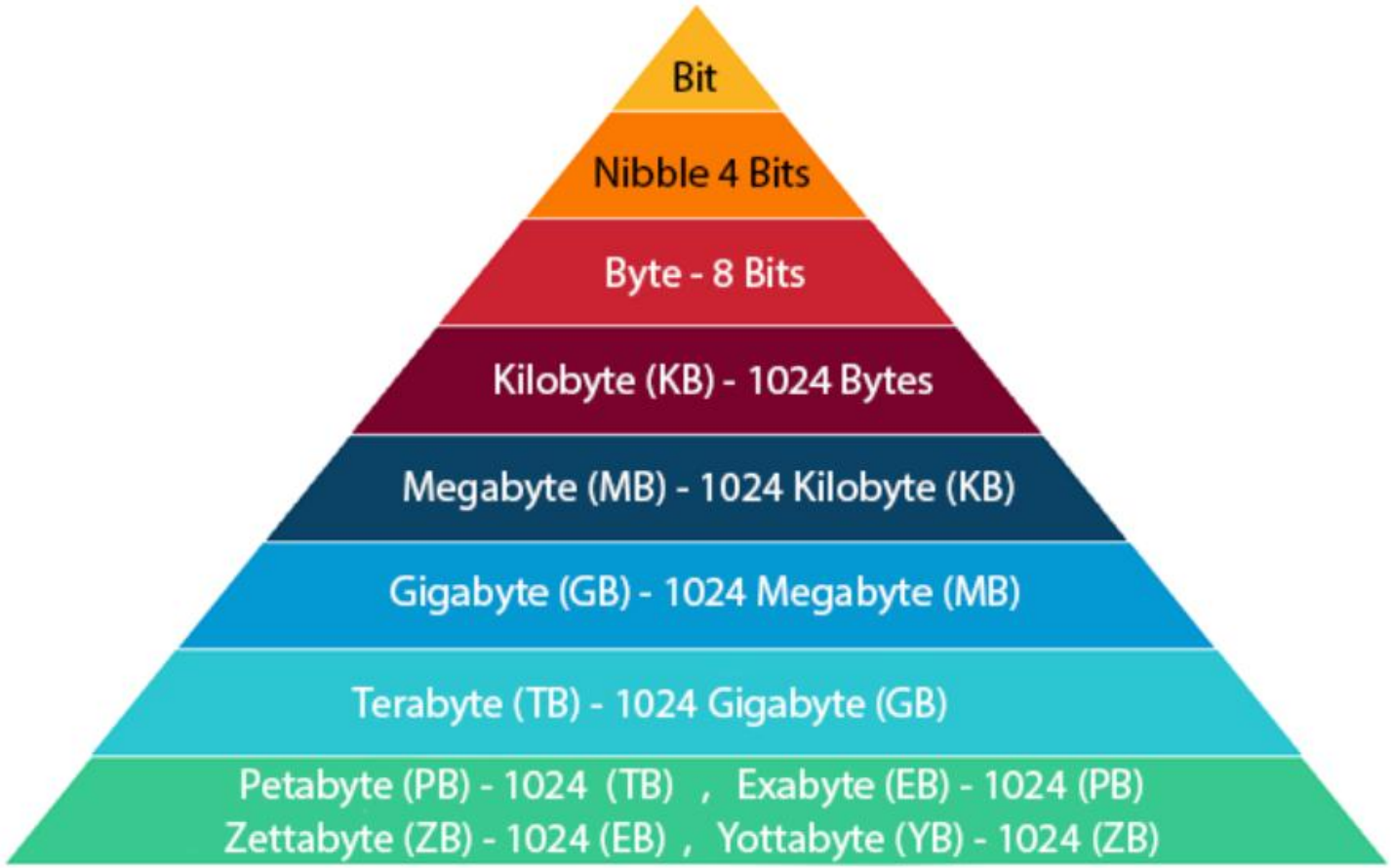
→ 1 Terabyte (TB) = 1024 GB

- **Example:**

1 text page ≈ 2 KB

1 photo ≈ 3 MB

1 movie ≈ 2 GB



❖ **Example 1 :** Convert 2 GB into MB, KB et Bytes

→ 1 GB = 1024 MB

2 GB = 2 × 1024 = 2048 MB

→1 MB = 1024 KB

2048 MB = 2048 × 1024 = 2,097,152 KB

→ 1 KB = 1024 Bytes

2,097,152 KB = 2,097,152 × 1024 = 2,147,483,648 Bytes

➢ **Exemple 2 :** Convert 5000 MB into GB et TB

→ 1 GB = 1024 MB

5000 MB ÷ 1024 ≈ 4.88 GB

→ 1 TB = 1024 GB

4.88 GB ÷ 1024 ≈ 0.0047 TB

- **Example 3 :** We have three USB drives: A = 16 GB, B = 800 MB, C = 512 KB.
  1.Rank the three USB drives from the largest to the smallest capacity.
  2.Which USB drive would be the most suitable to store a 700 MB movie?