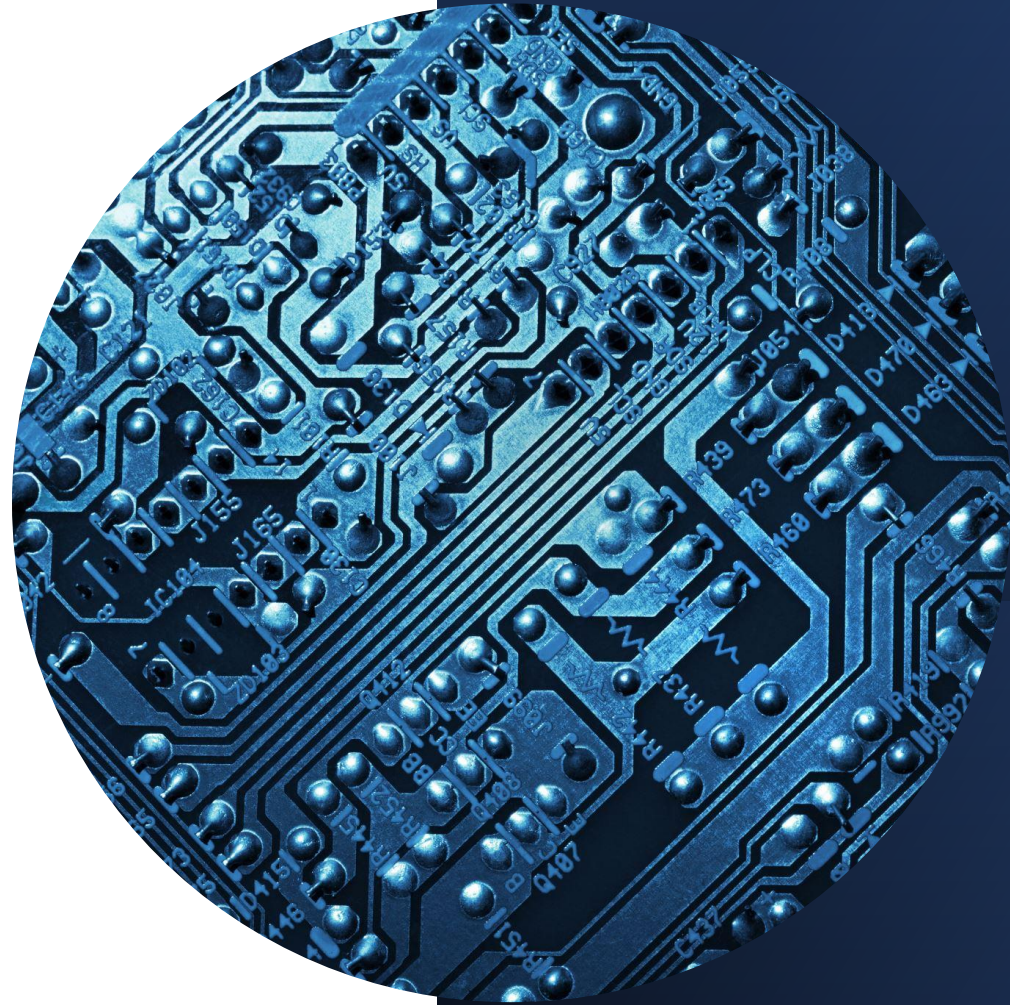# 104010 : BASIC ELECTRONICS ENGINEERING

UNIT III
DIGITAL ELECTRONICS

**Introduction to Micro-processors and Micro-controllers**

What is a Micro-processor?

- The microprocessor, also known as the Central Processing Unit (CPU), is the brain of all computers and many household and electronic devices.

- Multiple microprocessors, working together, are the "hearts" of datacenters, super-computers, communications products, and other digital devices.

Block Diagram of Microprocessor

☐ Basic Building Block of Microprocessor
  ☐ Input Device
  ☐ Arithmetic Logic Unit
  ☐ Control Unit
  ☐ Register Array
 ☐ Memory Unit
  ☐ Output Device
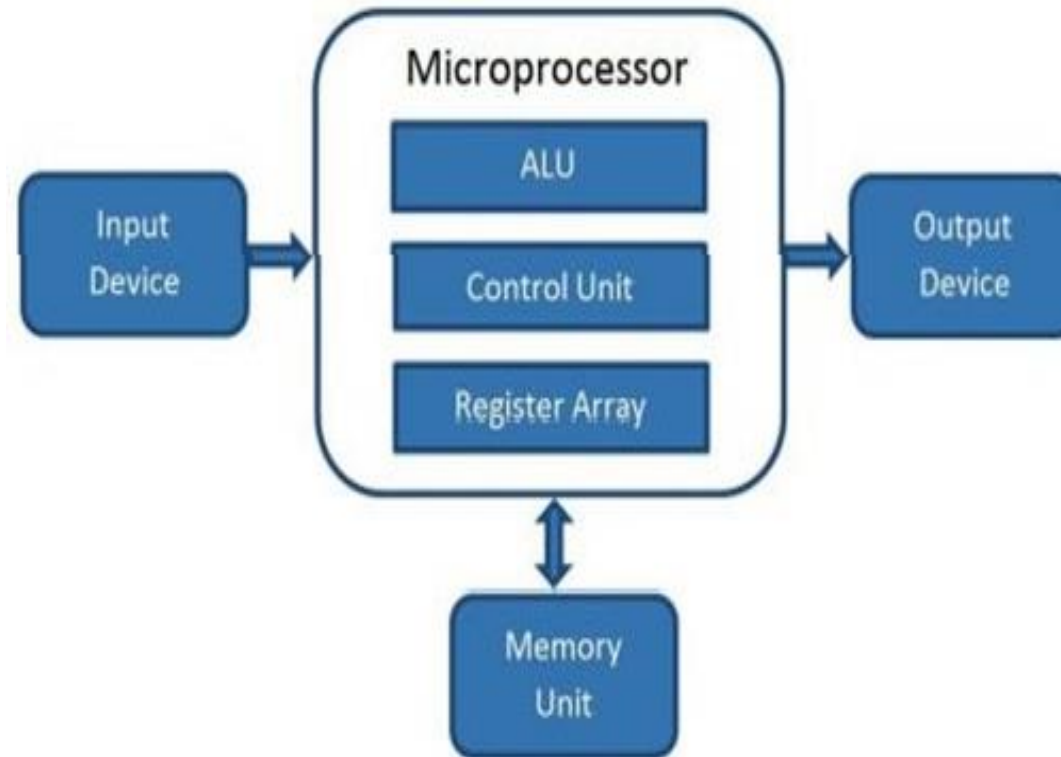
A Brief History of Microprocessors

- In 1971 **Intel 4004** at Intel corporation. It was the first single-chip microprocessor was the 4-bit.

- In 1972 **Intel 8008** at Intel corporation. It was an 8-bit CPU with an external 14-bit address bus that could address 16KB of memory.

- In (1971-1974) **TMS 1000** at Smithsonian Institution with **Texas Instruments** developed **TMS1802NC** on September 17, 1971. **TMS1802NC** was 4-bit, combined read-only memory, read/write memory, processor and clock on one chip and was targeted at embedded system.

- In 1977 **Intel 8048** at Intel corporation based on **TMS 1000.** It combined RAM and ROM on the same chip.

- In 1993 **PIC16x84** at Microchip Technology the introduction of **EEPROM** memory allowed microcontrollers. At The same year at "Atmel" introduced the first microcontroller using **Flash memory.**

What is a Micro-controller?

- A Microcontroller is a programmable digital processor with necessary peripherals.

- Both microcontrollers and microprocessors are complex sequential digital circuits meant to carry out job according to the program / instructions. Sometimes analog input/output interface makes a part of microcontroller circuit of mixed mode (both analog and digital nature).

- A microcontroller can be compared to a Swiss knife with multiple functions incorporated in the same IC.

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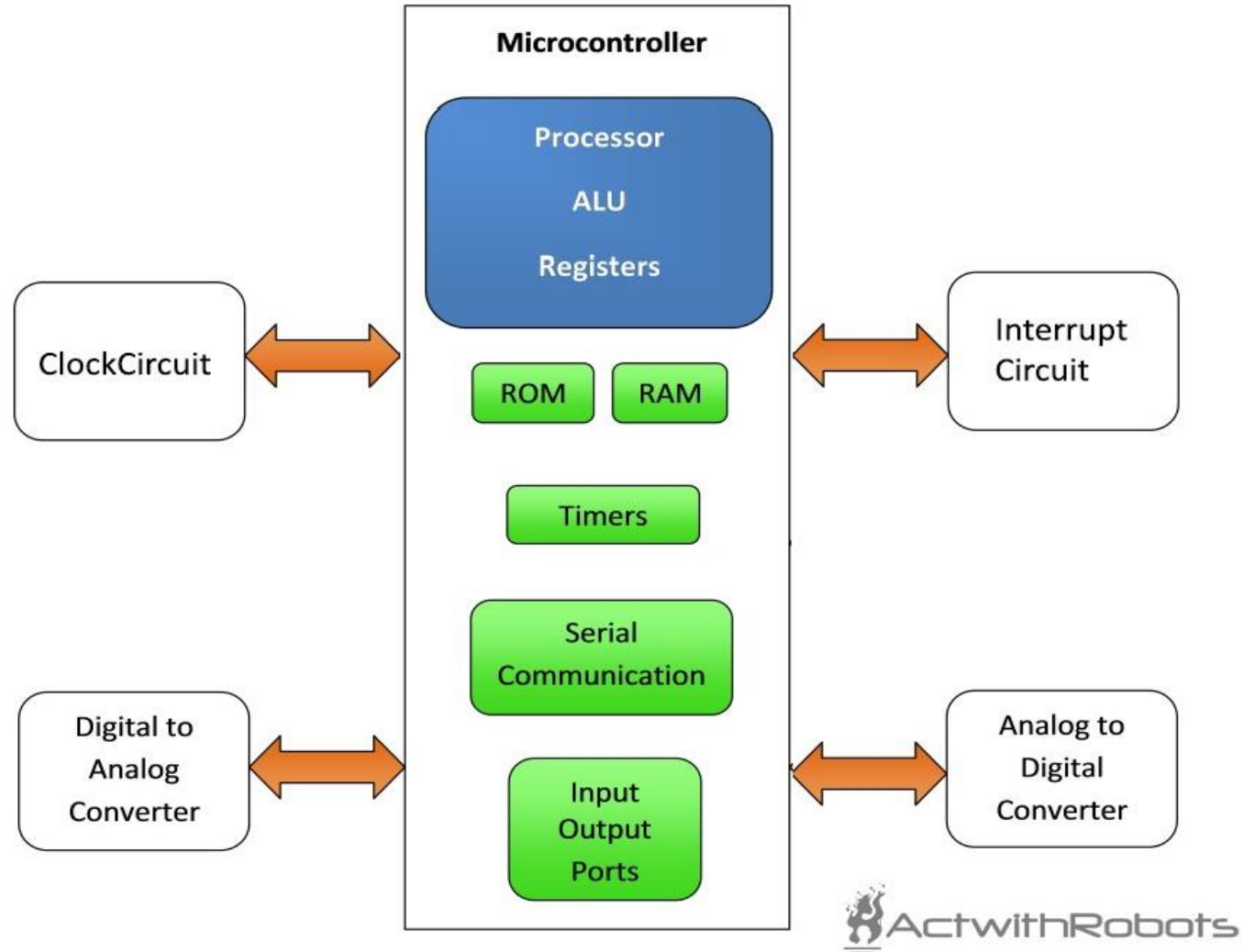
Microcontroller

History of Micro-controllers

Company	Processor	Year
INTEL 4004	4-bit	1971
INTEL 8085	8-bit	1974
INTEL 8048	8-bit	1976
INTEL 8031	8-bit(ROM-LESS)	-
INTEL 8051	8 bit(MASK ROM)	1980
INTEL 8086	16-bit	1978
Atmel At89C51	8-bit(Flash Memory)	1984
Microchip PIC16C64	8-bit	1985
Motorola 68HC11	8-bit(on chip ADC)	1985
AVR	8-bit RISC	1996

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Intel Microcontrollers

- Intel also created many significant µcontrollers besides producing the world's first ever microprocessor. The important ones produced by Intel are the 8048 and the 8051 microcontrollers.

- 8048 was introduced in 1976 and was the first of Intel's µcontroller. It was used as the processor in the PC keyboard of **IBM** (***International Business Machine***).

- The 8051 µcontroller was introduced in 1980 and is one of the most popular µcontroller. It is even used now and is considered to be one of the most long-lived µcontroller.

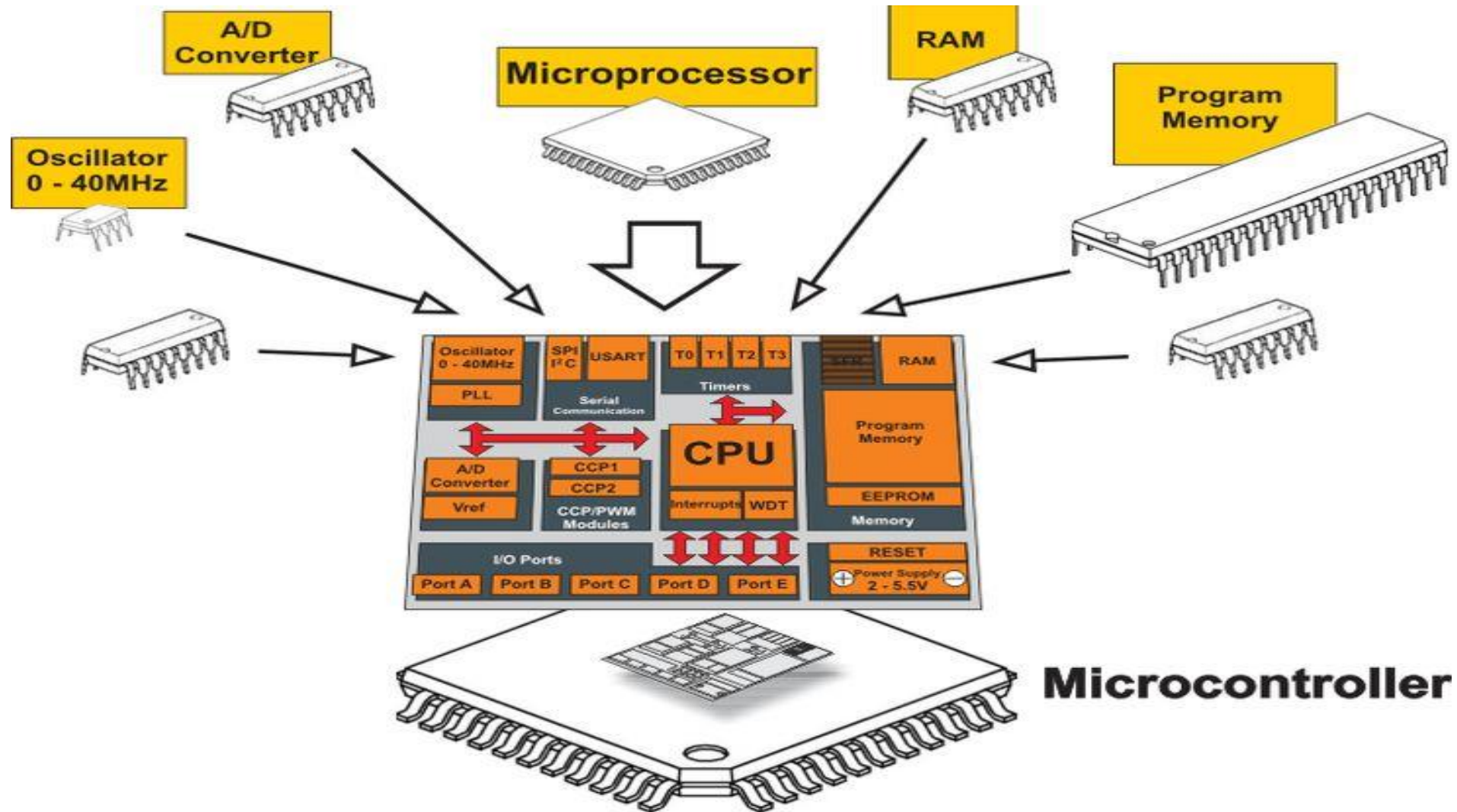**104010: Basic Electronics Engineering, Pune Institute of Computer Technology, Pune.**
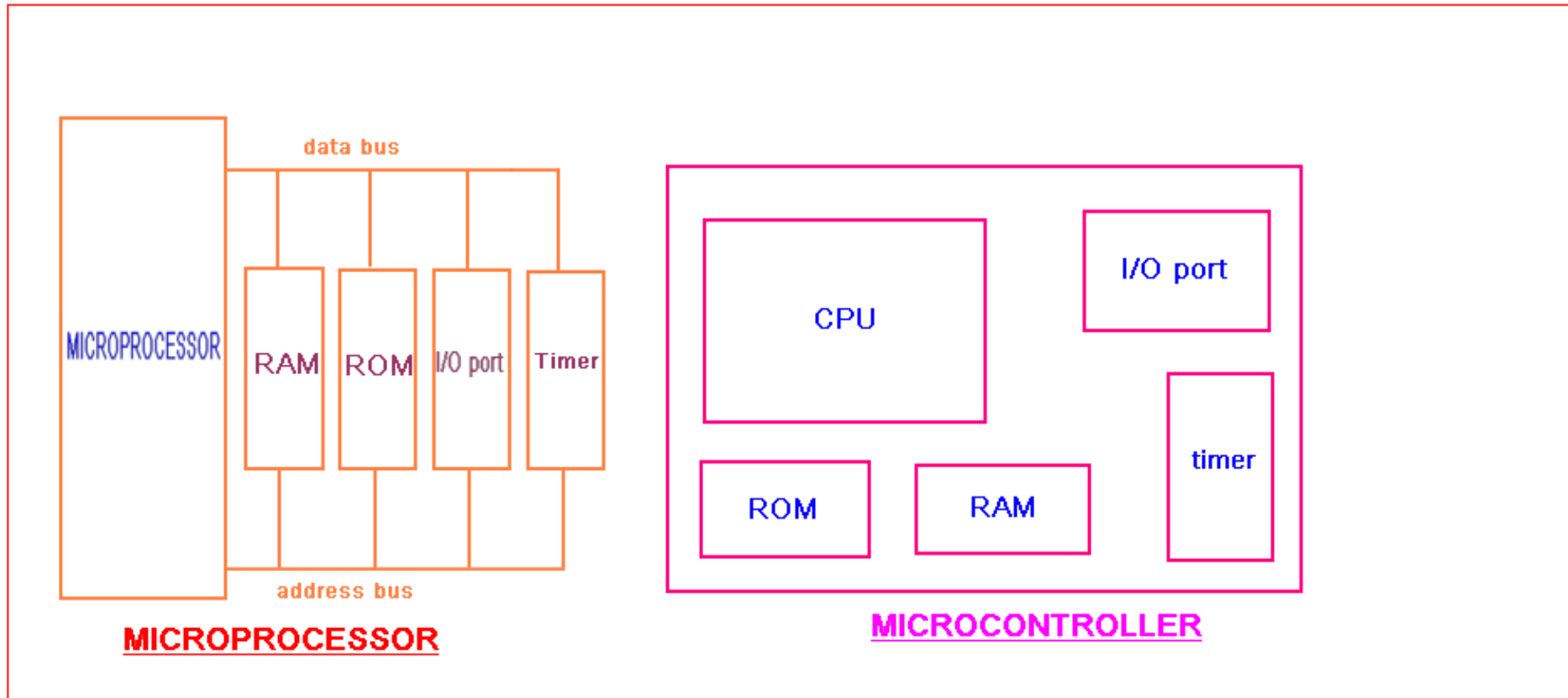
Modern Microcontrollers

- Today, in addition to the general-purpose gadgets, unique μcontrollers are being created for areas like lighting, automotive, communications, and low-power driven consumer goods.

- The present day μcontrollers like **AVR** [*Advanced Virtual RISC*], and **PIC** (*Peripheral Interface Controller*) have become smaller and sleeker yet more and more powerful. For instance, there are so tiny microcontrollers available, small and cheap enough to be used in simple products.

Atmel AVR   AVR   ATX Mega   ATmega 328P

PIC 18F877A   8051   Arduino   ARM

Micro-processor vs Micro-controller

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Micro-processor vs Micro-controller

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Difference Between Microprocessor and Microcontroller

Microprocessor	Microcontroller
It is a central processing unit built on a single silicon based integrated chip.	It is a byproduct of a development of a microprocessor.
It has no Memory, IO Units, Timers and other peripheral on the chips.	It has a CPU along with Memory, IO Units, Timers and other peripherals embedded on the single chip.
It uses an external bus to interface Memory, IO Units, Timers and other peripherals.	It uses an internal controlling bus which is not available to the board designer.
It is used for general purpose applications which are able to handle loads of data.	It is used for application specific systems.
It is complex and expensive with large number of instructions to process.	It is simple and inexpensive with less number of instructions to process.
e.g. 8085,8086,80x86	e.g. 8051, PIC, ARM

Micro-processor vs Micro-controller

	Microprocessor	Microcontroller
System	It is the heart of the computer system.	It is the heart of an embedded system.
Contains	It contains CPU, general purpose registers, stack pointers, program counters, clock timing and interrupt circuits.	It contains the circuitry of microprocessor and has built-in ROM, RAM, I/O devices, timers and counters.
Data memory	It has many instructions to move data between memory and CPU.	It has one or two instructions to move data between memory and CPU.
Circuit	It is large.	It is small.
Cost	Cost of the entire system increases.	Cost of the entire system is low.
Bit instructions	It has one or two bit handling instructions.	It has many bit handling instructions.
Register numbers	It has less number of registers; hence the operations are memory based.	It has more number of registers; hence the programs are easier to write.
Storage	It is based on Von Neumann architecture, where the program and data are stored in the same memory module.	It is based on the Harvard architecture, where the program memory and data memory are stored in separate module.
Time	Access time for memory and I/O devices is more.	Less access time for built-in memory and I/O devices.
Hardware	It requires more hardware.	It requires less hardware.

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Acknowledgements

Modern Digital Electronics: R P Jain

Web sources

Thank you!