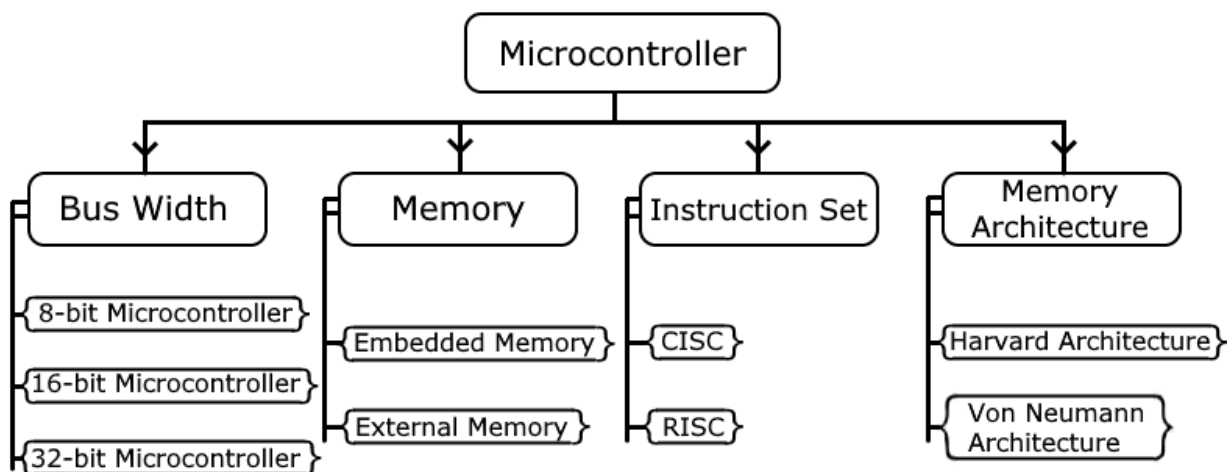## UNIT II: MICROCONTROLLER

Introduction to microcontrollers and microprocessors, Different microcontrollers, Arduino: Types, UNO Architecture, ADC, DAC, Data acquisition

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## 2.2 Different Microcontrollers

How are Microcontrollers Classified

- ❖ The microcontrollers are characterized regarding bus-width, memory, instruction set, and memory structure.
- ❖ For the same family, there may be different forms with different sources.
- ❖ **Classification According to Number of Bits:**
- ❖ **8-bit** microcontroller
- ❖ **16-bit** microcontroller
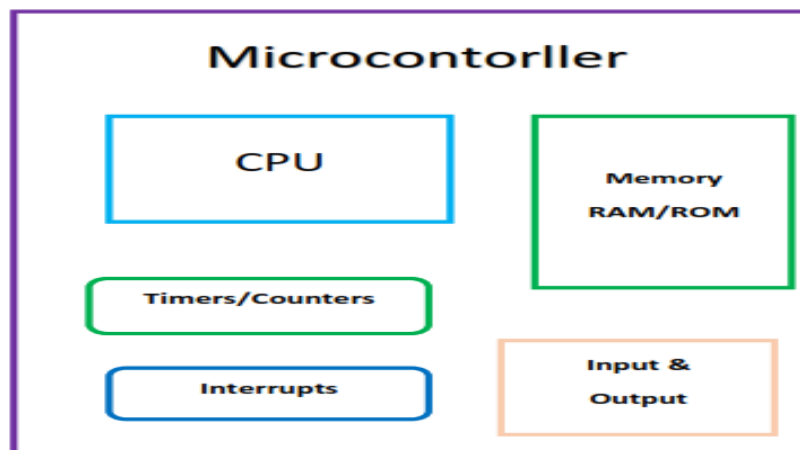- ❖ **32-bit** microcontroller



## Types of Microcontroller

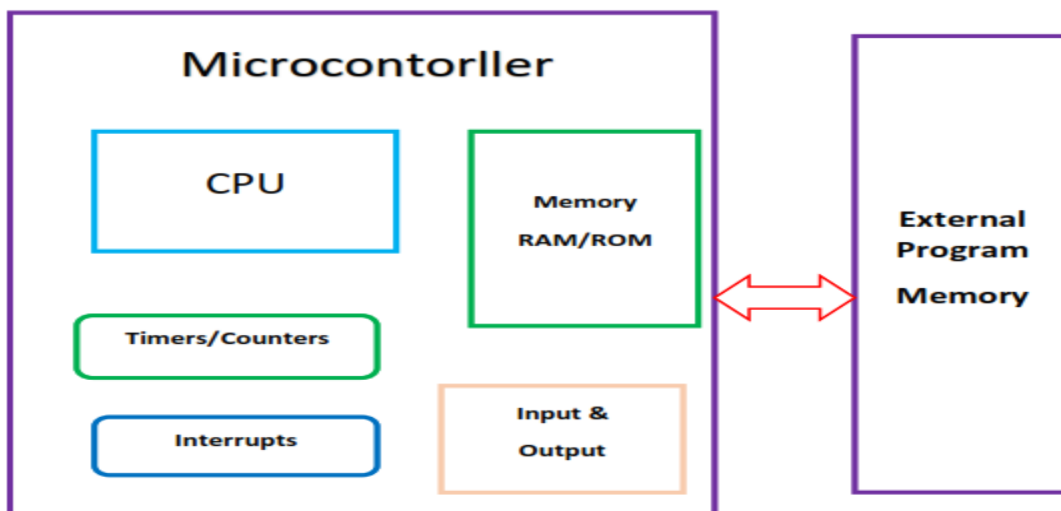## Classification According to Memory Devices:

**Embedded memory microcontroller:**

- ❖ When an embedded system has a microcontroller unit that has all the functional blocks available on a chip is called an embedded microcontroller. For example, 8051 having program & data memory, I/O ports, serial communication, counters and timers and interrupts on the chip is an embedded microcontroller.

**External Memory Microcontroller:**

❖ When an embedded system has a microcontroller unit that has not all the functional blocks available on a chip is called an external memory microcontroller.

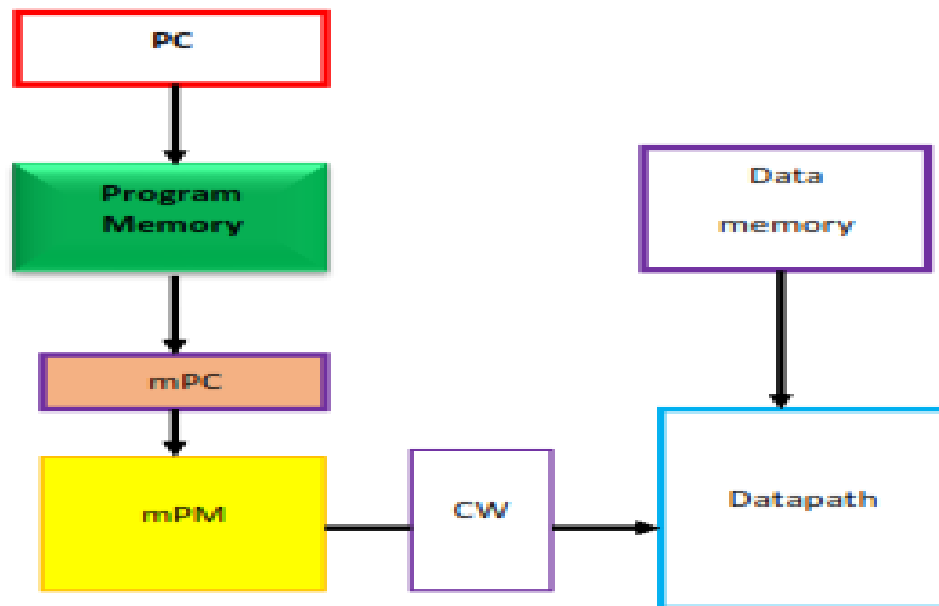❖ For example, 8031 has no program memory on the chip is an external memory microcontroller.



## Classification According to Instruction Set:
**CISC**:

    ❖ CISC is a Complex Instruction Set Computer. It allows the programmer to use one instruction in place of many simpler instructions.
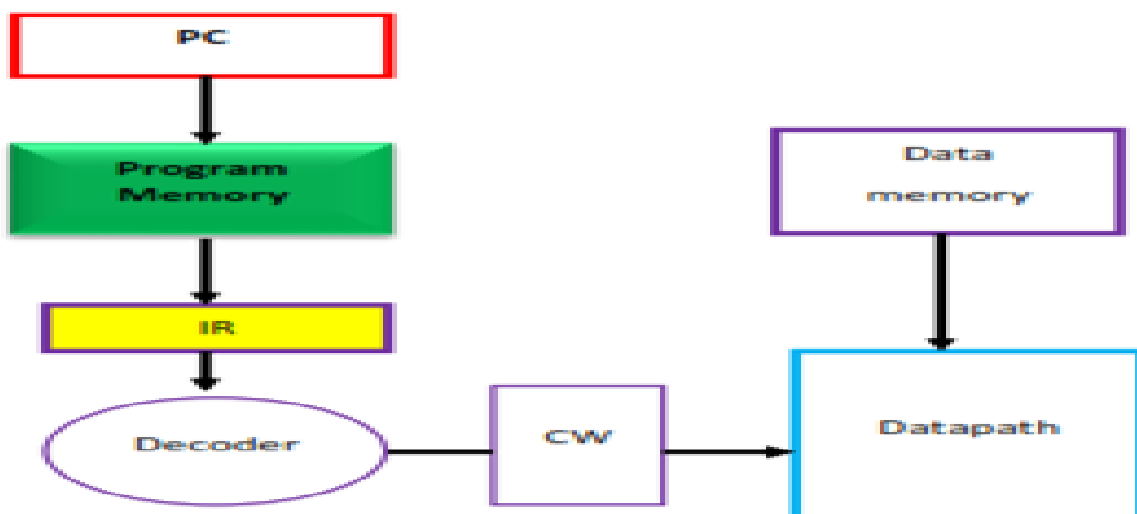
## CISC



**RISC**:

❖ The RISC is stands for Reduced Instruction set Computer, this type of instruction sets reduces the design of microprocessor for industry standards. It allows each instruction to operate on any register or use any addressing mode and simultaneous access of program and data.
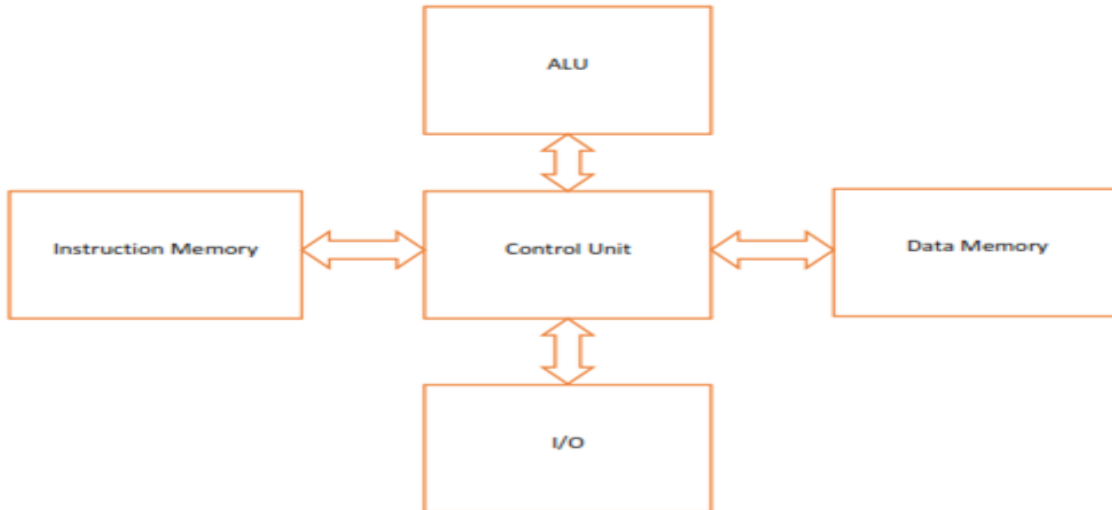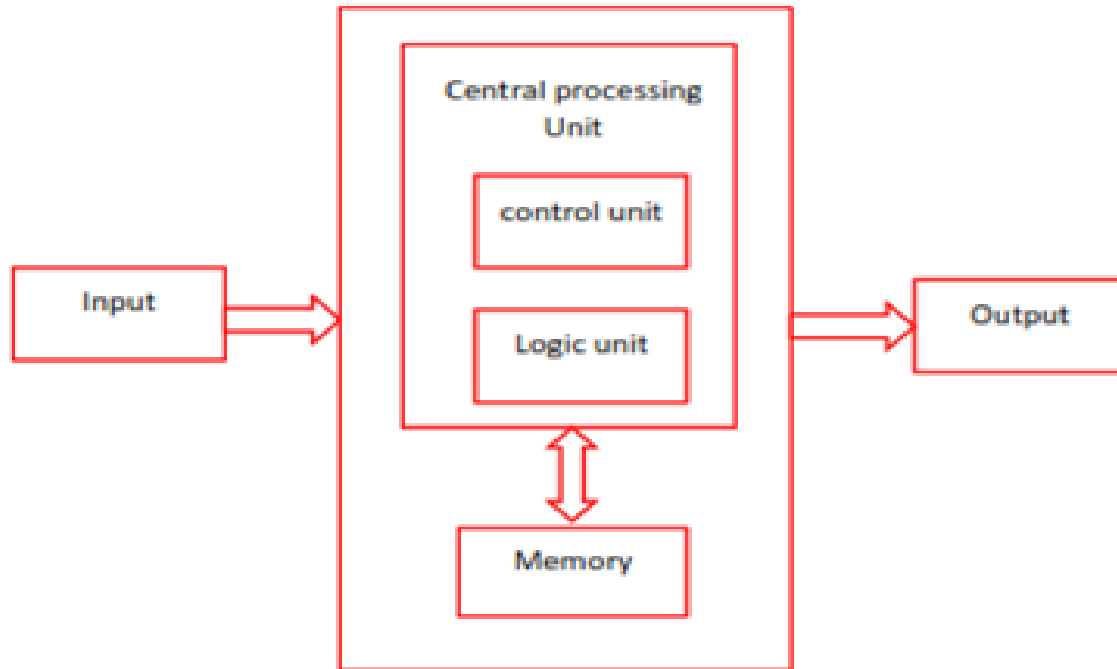
## RISC



## Classification According to Memory Architecture:
**Harvard Architecture**:

❖ In Harvard architecture separate storage and signal buses are provided for different set of instructions and data. This architecture has the entire data storage within the CPU and there is no access available for instruction storage as data.

❖ This architecture provides simultaneous access to an instructions and data stored inside internal buses of microcontroller.



**Von Neumann Architecture**:

❖ This architecture of microcontroller was proposed by scientist John Von Neumann. In this architecture for both instruction and data a single data path or bus is present.

❖ Therefore, the CPU performs a single operation at a time. It either performs Read/Write operation on data, or fetches a set of instruction from memory. Hence instruction fetch and a data transfer operation cannot occur simultaneously by using a common bus.

**Classification According to the basis of Service Provider:**

❖ **AVR**: AVR microcontroller is developed by Atmel service provider, AVR architecture is based on the Harvard architecture. It is based on Reduced Instruction Set Computers(RISC). AVR is not an acronym it is just a name given to the RISC architecture based microcontroller.

❖ **PIC**: PIC microcontroller is also a Harvard architecture-based controller. PIC is an acronym stands for "Peripheral Interface Controller". This type of microcontroller supports programming in C, Assembly and BASIC C.

❖ **Hitachi**: Hitachi microcontroller belongs to H8 family of the controller. H8 is name used in large family of 8-bit, 16-bit and 32-bit microcontroller developed by Renesas Technology, founded in an early 1990s within Hitachi semiconductors.

❖ **Motorola**: Motorola microcontroller is highly integrated microcontroller that is used for high-performance data manipulation operation. This microcontroller unit uses a System Integration Module (SIM), Time Processing Unit (TPU) and Queued Serial Module(QSM).