ALU, CU and Register Array

- Microprocessor consists of an ALU, register array, and a control unit.
- ALU performs arithmetical and logical operations on the data received from the memory or an input device.
- Register array consists of registers identified by letters like B, C, D, E, H, L and accumulator.
- The control unit controls the flow of data and instructions within the computer.

How does the microprocessor works?

- The microprocessor follows a sequence: Fetch, Decode, and then Execute.
- Initially, the instructions are stored in the memory in a sequential order.
- The microprocessor fetches those instructions from the memory, then decodes it and executes those instructions till STOP instruction is reached.
- Later, it sends the result in binary to the output port.
- Between these processes, the register stores the temporarily data and ALU performs the computing functions.

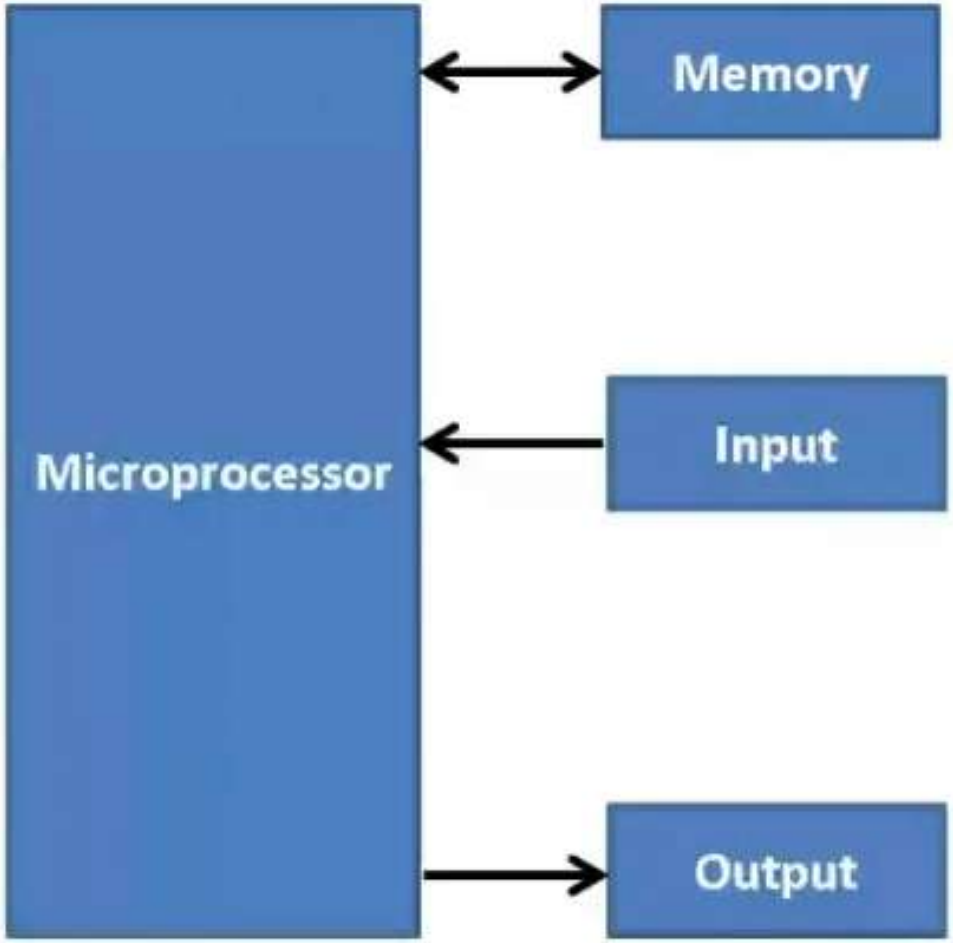
Features of a Microprocessor

- **Cost-effective** – The microprocessor chips are available at low prices and results its low cost.
- **Size** – The microprocessor is of small size chip, hence is portable.
- **Low Power Consumption** – Microprocessors are manufactured by using metaloxide semiconductor technology, which has low power consumption.
- **Versatility** – The microprocessors are versatile as we can use the same chip in a number of applications by configuring the software program.
- **Reliability** – The failure rate of an IC in microprocessors is very low, hence it is reliable.

Microprocessor and Microcomputer

- Computer's Central Processing Unit (CPU) built on a **single Integrated Circuit (IC)** is called a **microprocessor**.
- Microprocessor is a *programmable, multipurpose, clock -driven, register-based electronic device* that reads binary instructions from a storage device called *memory*, accepts binary data as input and processes data according to those instructions and provides results as output.
- A digital computer with one microprocessor which acts as a CPU is called **microcomputer**.

Programmable Machine

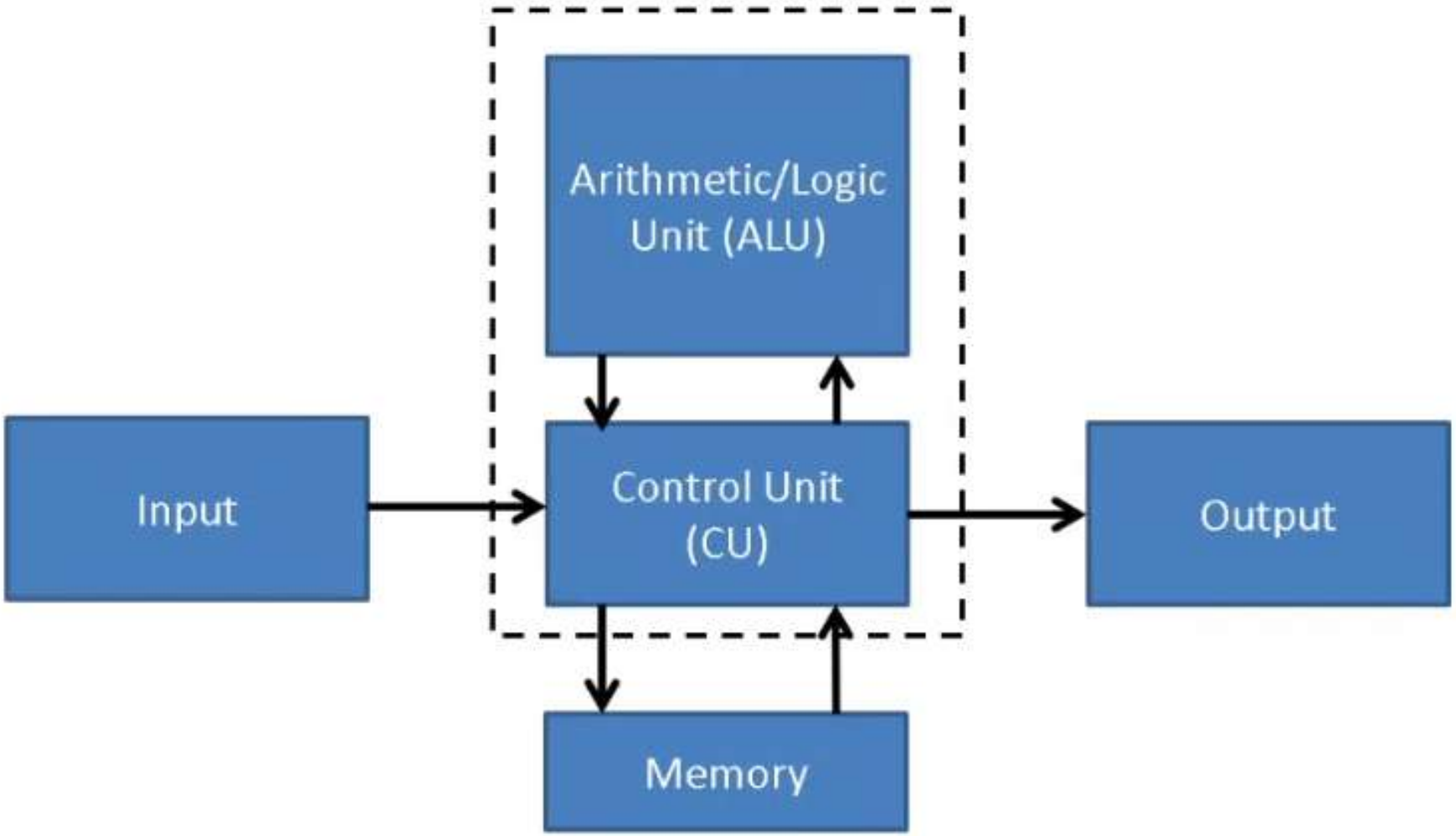


- A typical programmable machine can be represented with four components: microprocessor, memory, input, and output
- These four components work together or interact with each other to perform a given task; thus, they comprise a system.
- The physical components of this system are called hardware.
- A set of instructions written for the microprocessor to perform a task is called a program, and a group of programs is called software.

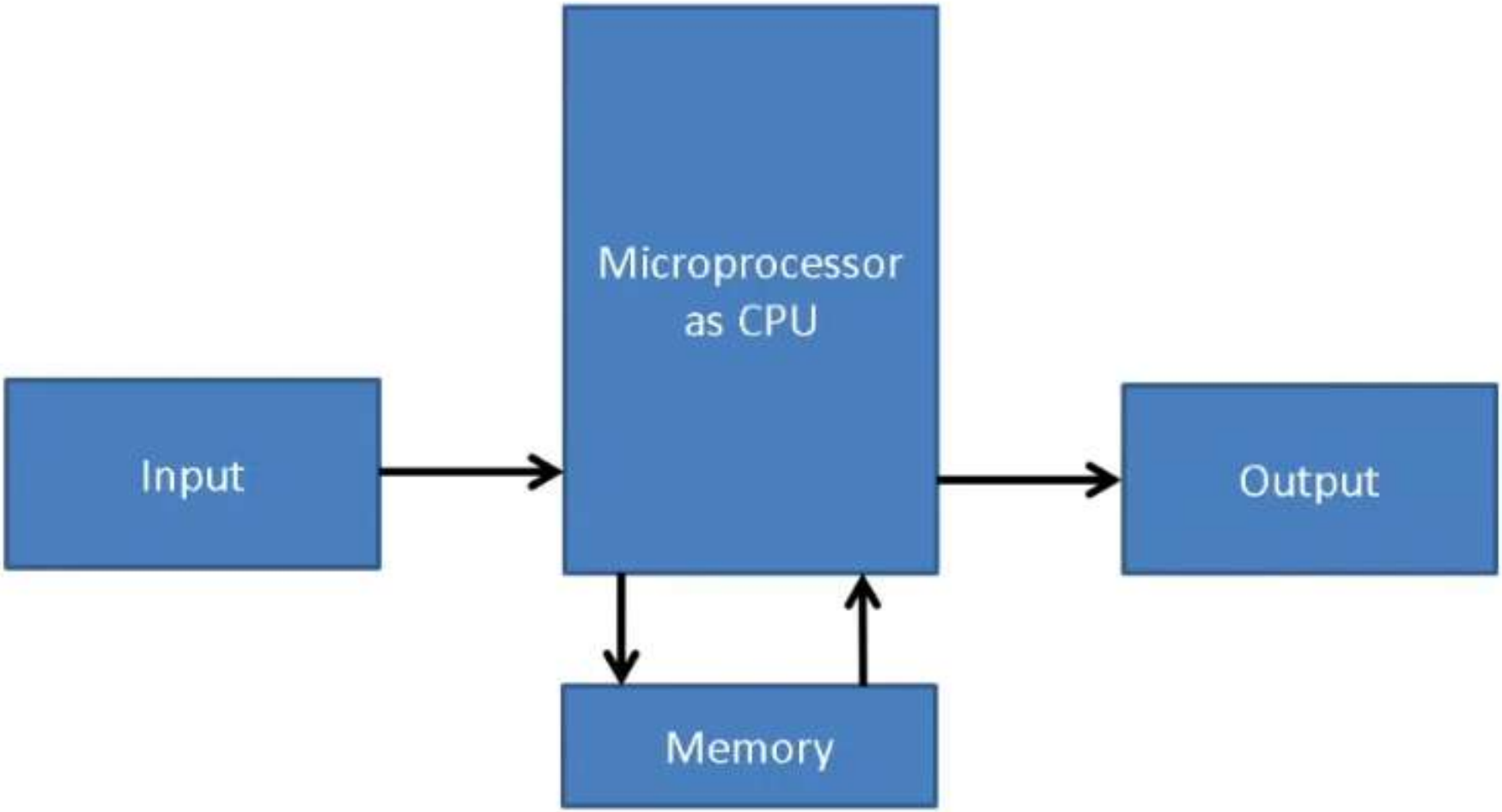
Microprocessor Applications

- The microprocessor applications are classified primarily in two categories
  - **Reprogrammable systems**: such as microcomputers, the microprocessor is used for computing and data processing. These systems include: – general-purpose microprocessors capable of handling large data, mass storage devices (such as disks and CD-ROMs), and peripherals such as printers; a personal computer (PC) is a typical illustration.
  - **Embedded systems**: the microprocessor is a part of a final product and is not available for reprogramming to the end user. Example: copying machine, washing machine, Air-conditioner.

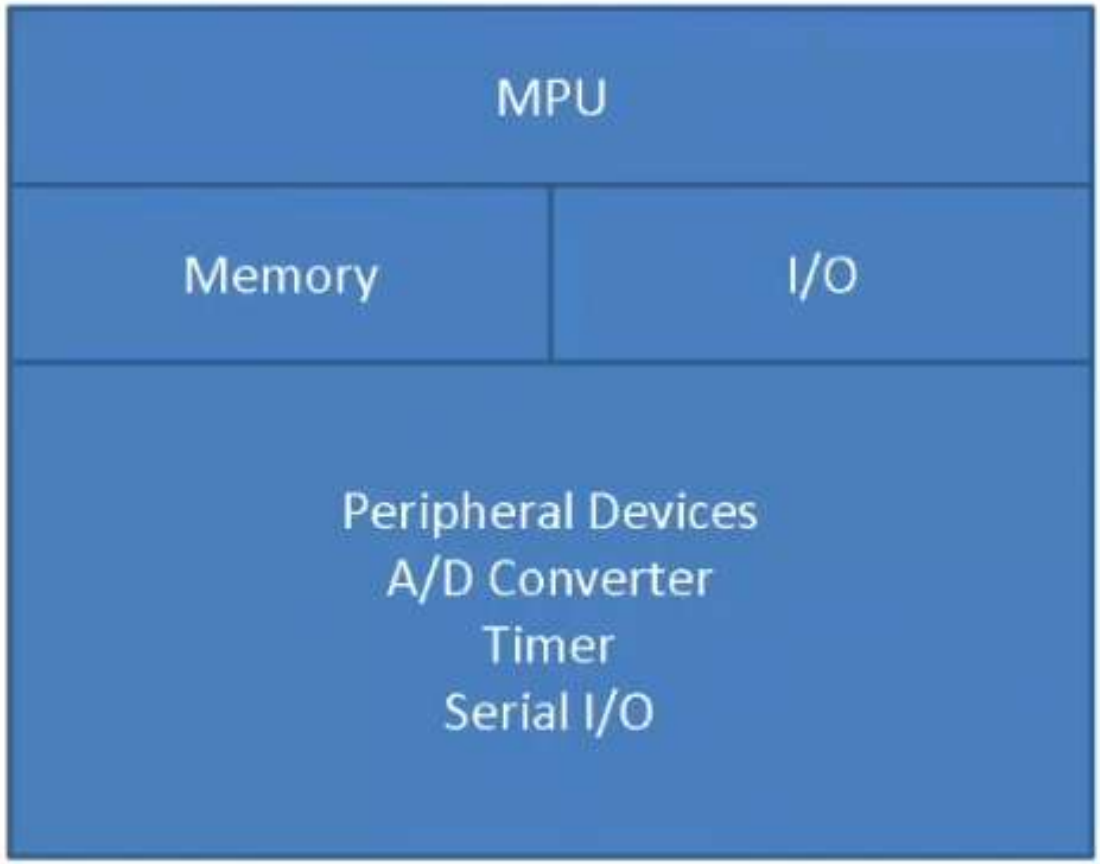
Traditional computer



Microprocessor as CPU



Microcontroller



Microprocessor Programing

- The microprocessor communicates and operates in the binary numbers 0 and 1, called bits.
- Each microprocessor has a *fixed set of instructions* in the form of binary patterns called a **machine language**.
- It is difficult for humans to communicate in the language of 0 s and 1 s.
- Therefore, the binary instructions are given abbreviated names, called **mnemonics**, which form the **assembly language** for a given microprocessor.

Microprocessor Programing

- Each MPU recognises and processes a *group of bits* called the **word**.
- A word is a group of bits the computer recognizes and processes at a time.
- Microprocessors are classified according to their word length. For example, a processor with an 8-bit word is known as an 8-bit microprocessor, and a processor with a 32-bit word is known as a 32-bit microprocessor.

History of Microprocessor

Processor	Year	No. of Transistors	Address Bus (bit)	Data Bus (bit)
4004	1971	2300	10	4
8008	1972	3500	14	8
8080	1974	6000	16	8
8085	1976	6500	16	8
8086	1978	29000	20	16
8088	1979	29000	20	8
80286	1982	134000	24	16
80386	1985	275000	32	32
80486	1989	1.2 M	32	32

History of Microprocessor

Processor	Year	No. of Transistors	Address Bus (bit)	Data Bus (bit)
Pentium	1993	3.1 M	32	32/64
Pentium Pro	1995	5.5 M	36	32/64
Pentium II	1997	8.8 M	36	64
Pentium III	1999	9.5 M	36	64
Pentium 4	2000	42 M	36	64
Intel Core-2	2006	291 M	36	64

Microprocessor system with Bus architecture