UNIT II: MICROCONTROLLER

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

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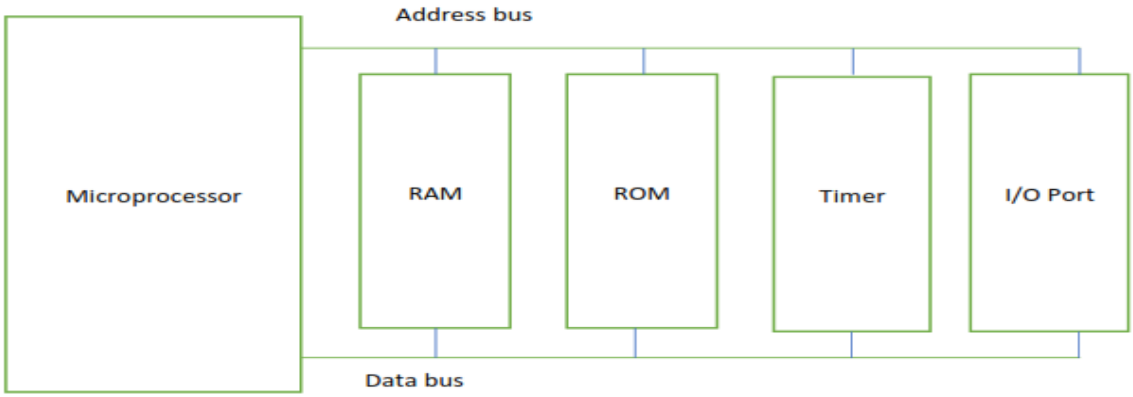
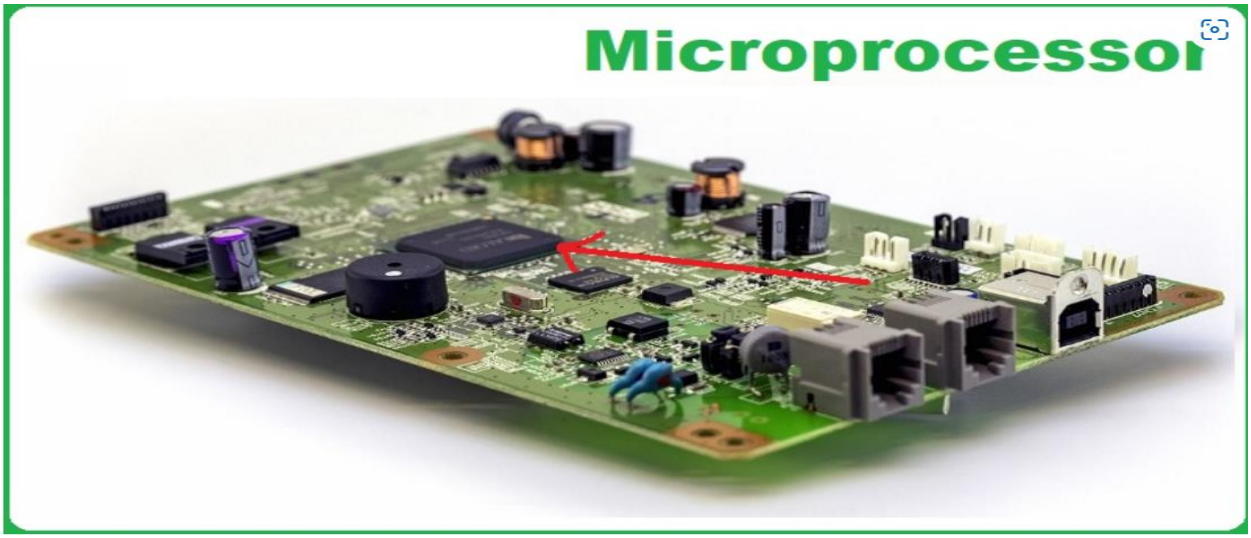
2.1 Introduction to Microcontrollers and Microprocessors

What is a Microprocessor?

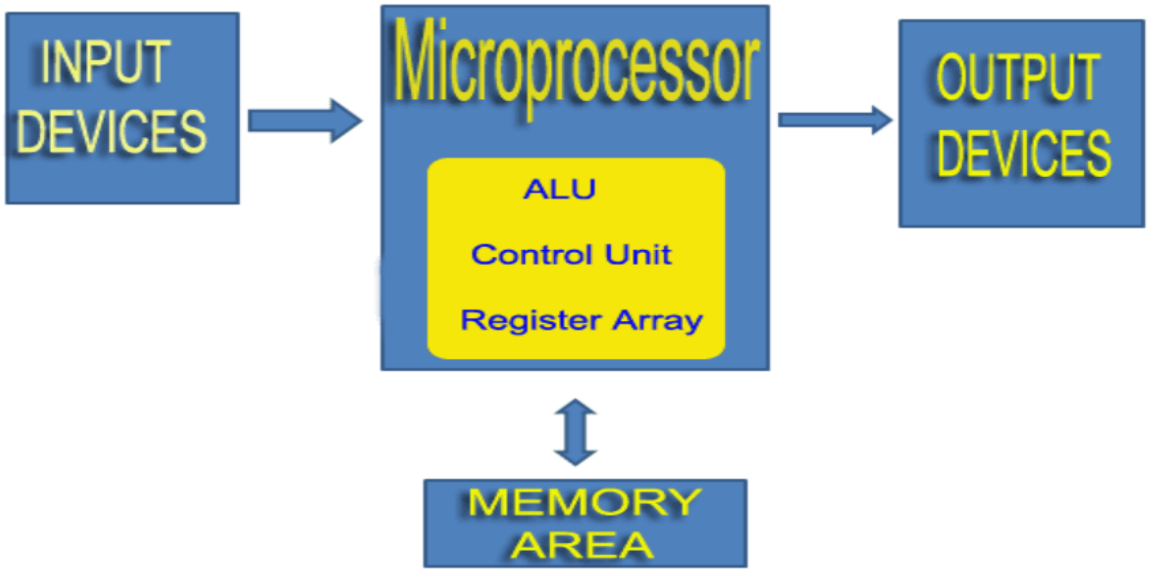
- A microprocessor is a controlling unit of a micro-computer wrapped inside a small chip.
- It performs Arithmetic Logical Unit (ALU) operations and communicates with the other devices connected with it. It is a single Integrated Circuit in which several functions are combined.



Microprocessor is a **hardware component of computer**, and it works as brain of the computer system as well as **use in computer** because without using microprocessor, Computer like as plastic box.



Block Diagram of Microprocessor



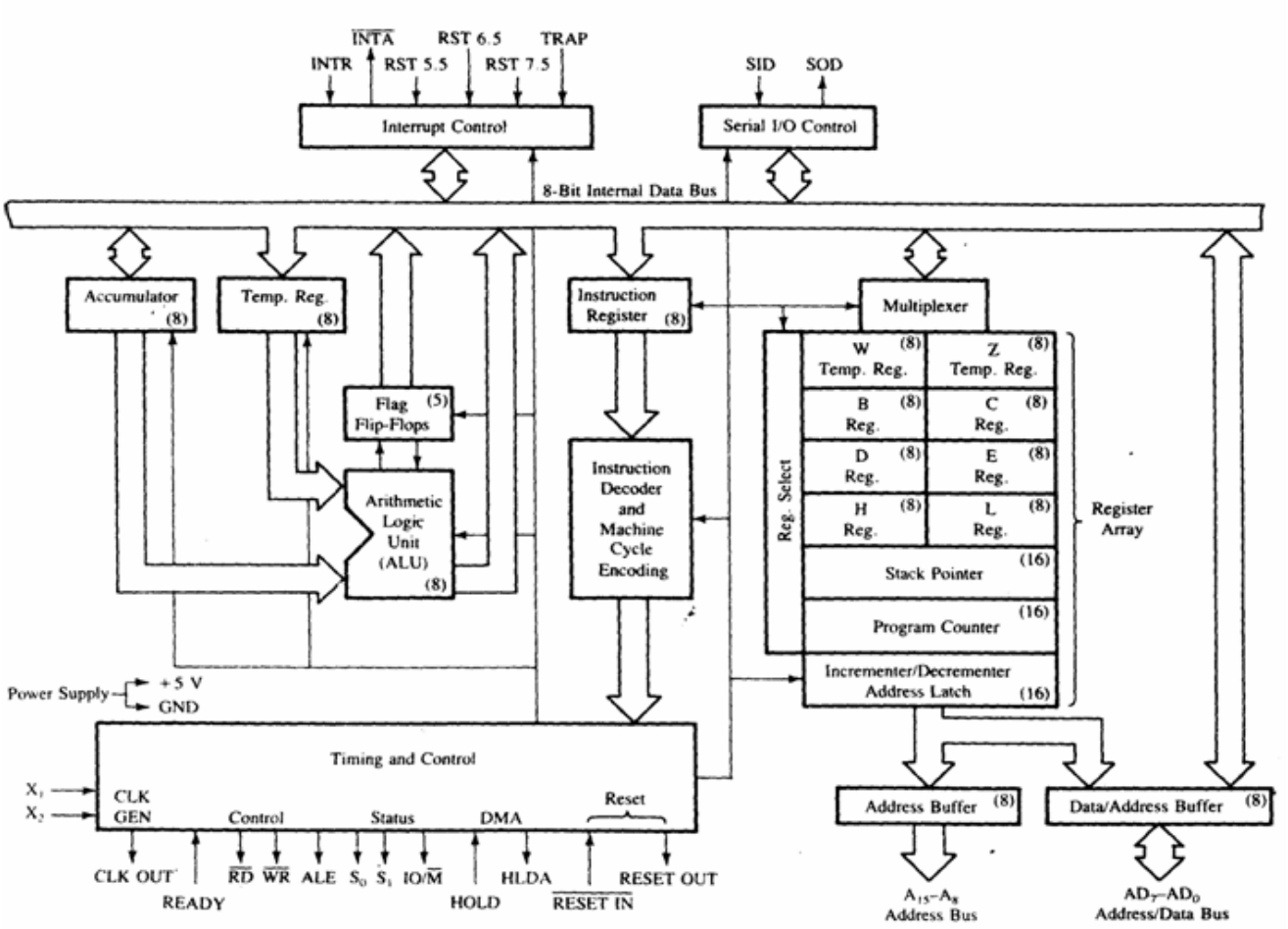
Users can send input to microprocessor with the help of different types of input devices of computer such as **mouse**, keyboard, touchpad, and touch screen etc.
Microprocessor manipulates all calculation such as adding/subtracting with using ALU, control Unit, and Register Array. After executing the instructions store it into memory area, and finally send those output for displaying on the output devices such as **computer monitor**.

Microprocessor Architecture

Here we are going to discuss the architecture of the 8085 microprocessor.

The 8085 is an 8-bit device. The configuration of the 8085 includes an address bus of 16 bits, a data bus of 8 bits, a stack pointer of 16 bits, the program counter of 16 bits and registers of 8 bits each.

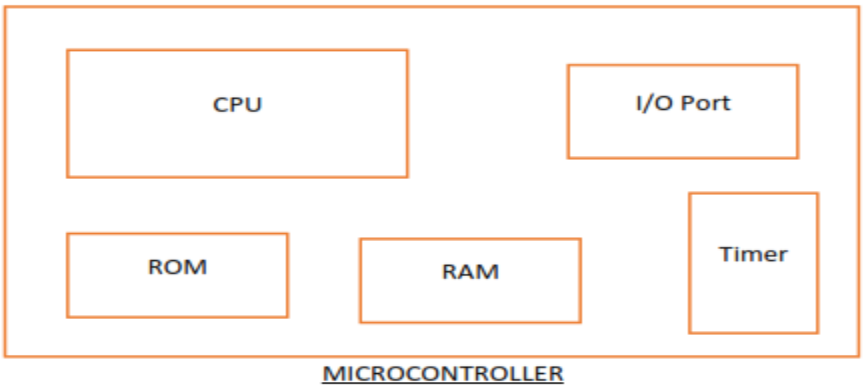
The device works at 3.2 MHz. The architecture mainly consists of the arithmetic and logic unit, timing and control unit, instruction register, decoder, interrupt control register and serial input-output control. The ALU performs the various arithmetic and logic operations while the timing and control unit brings about coordination between all the parts of the microprocessor.

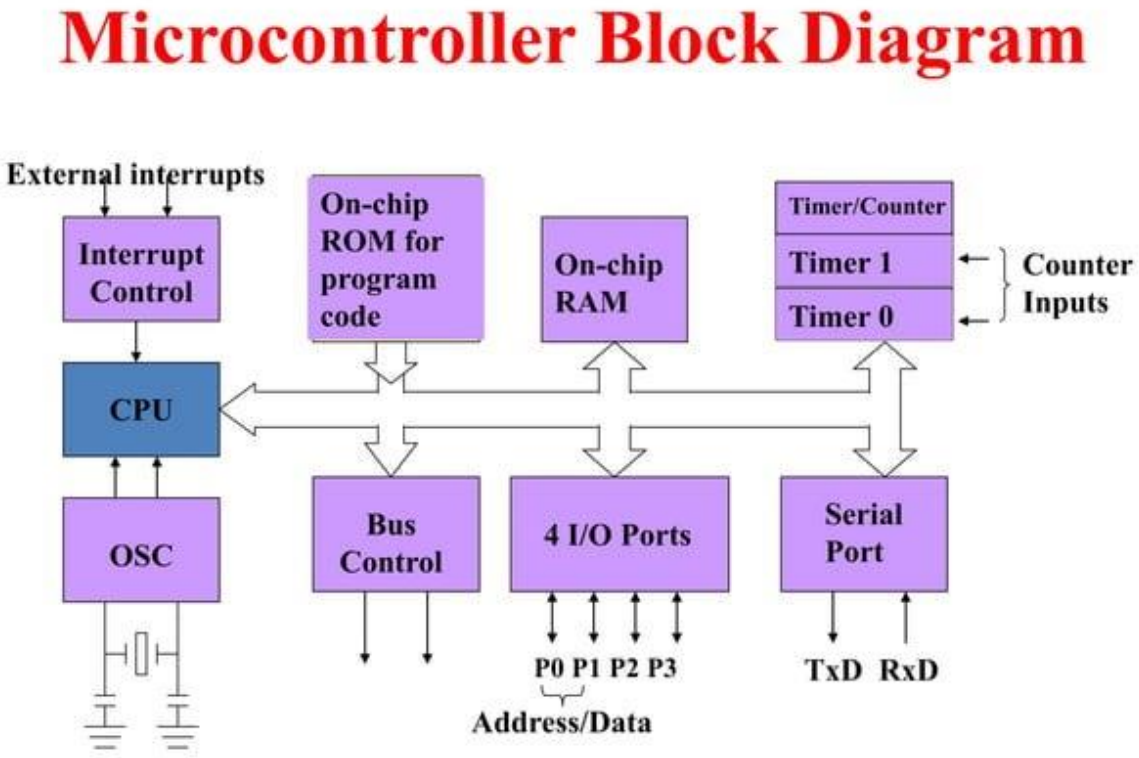


Architecture

What is Microcontroller?

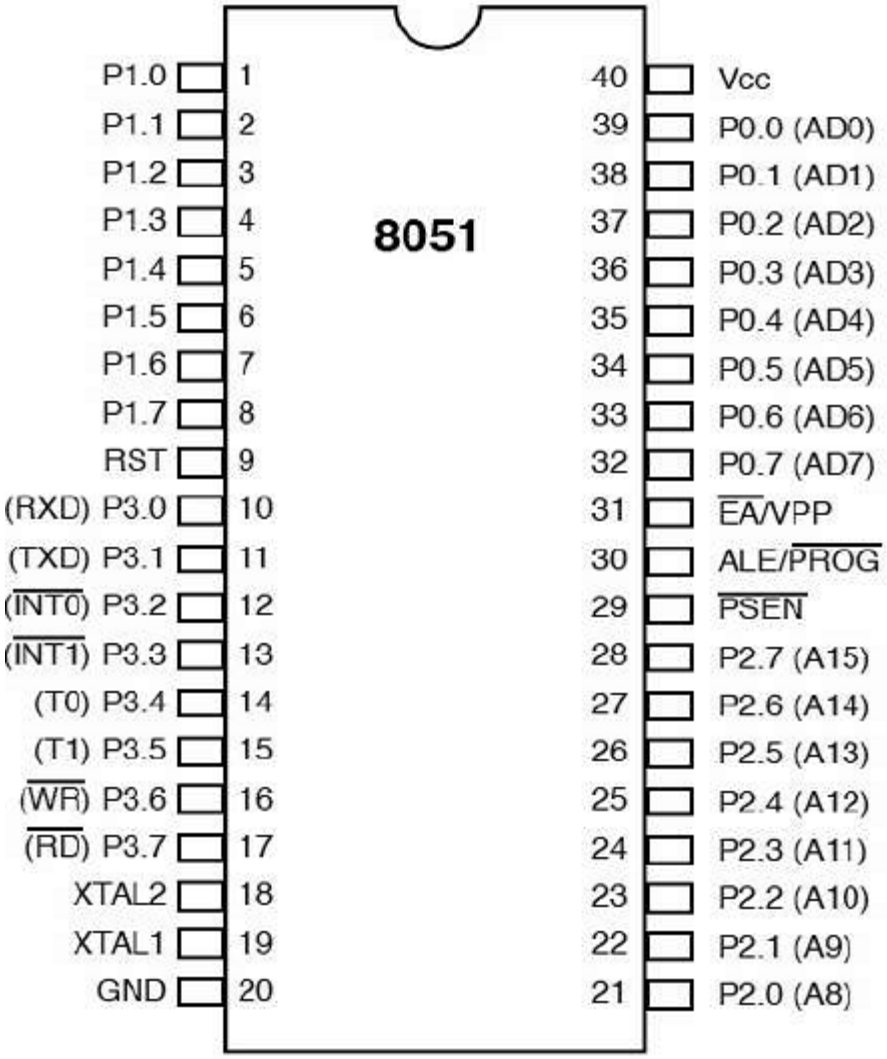
- A microcontroller is a chip optimized to control electronic devices.
- It is stored in a single integrated circuit which is dedicated to performing a particular task and execute one specific application.
- It is specially designed circuits for embedded applications and is widely used in automatically controlled electronic devices. It contains memory, processor, and programmable I/O.





The pin diagram of 8051 microcontroller looks as follows –

- **Pins 1 to 8** − These pins are known as Port 1. This port doesn't serve any other functions. It is internally pulled up, bi-directional I/O port.
- **Pin 9** − It is a RESET pin, which is used to reset the microcontroller to its initial values.
- **Pins 10 to 17** − These pins are known as Port 3. This port serves some functions like interrupts, timer input, control signals, serial communication signals RxD and TxD, etc.
- **Pins 18 & 19** − These pins are used for interfacing an external crystal to get the system clock.



- **Pin 20** − This pin provides the power supply to the circuit.
- **Pins 21 to 28** − These pins are known as Port 2. It serves as I/O port. Higher order address bus signals are also multiplexed using this port.
- **Pin 29** − This is PSEN pin which stands for Program Store Enable. It is used to read a signal from the external program memory.
- **Pin 30** − This is EA pin which stands for External Access input. It is used to enable/disable the external memory interfacing.
- **Pin 31** − This is ALE pin which stands for Address Latch Enable. It is used to demultiplex the address-data signal of port.
- **Pins 32 to 39** − These pins are known as Port 0. It serves as I/O port. Lower order address and data bus signals are multiplexed using this port.
- **Pin 40** − This pin is used to provide power supply to the circuit.

Difference between Microprocessor and Microcontroller:

Microprocessor	Microcontroller
Microprocessor is the heart of Computer system.	Micro Controller is the heart of an embedded system.
It is only a processor, so memory and I/O components need to be connected externally.	Micro Controller has a processor along with internal memory and I/O components.
Memory and I/O has to be connected externally, so the circuit becomes large.	Memory and I/O are already present, and the internal circuit is small.
You can't use it in compact systems	You can use it in compact systems.
Cost of the entire system is high	Cost of the entire system is low
Due to external components, the total power consumption is high. Therefore, it is not ideal for the devices running on stored power like batteries.	As external components are low, total power consumption is less. So it can be used with devices running on stored power like batteries.
Most of the microprocessors do not have power saving features.	Most of the microcontrollers offer power-saving mode.
It is mainly used in personal computers.	It is used mainly in a washing machine, MP3 players, and embedded systems.
Microprocessor has a smaller number of registers, so more operations are memory-based.	Microcontroller has more register. Hence the programs are easier to write.
Microprocessors are based on Von Neumann model	Micro controllers arc based on Harvard architecture
It is a central processing unit on a single silicon-based integrated chip.	It is a by-product of the development of microprocessors with a CPU along with other peripherals.
It has no RAM, ROM, Input-Output units, timers, and other peripherals on the chip.	It has a CPU along with RAM, ROM, and other peripherals embedded on a single chip.
It uses an external bus to interface to RAM, ROM, and other peripherals.	It uses an internal controlling bus.
Microprocessor-based systems can run at a very high speed because of the technology	Microcontroller based systems run up to 200MHz or more depending on the

involved.	architecture.
It's used for general purpose applications that allow you to handle loads of data.	It's used for application-specific systems.
It's complex and expensive, with a large number of instructions to process.	It's simple and inexpensive with less number of instructions to process.

Applications of Microprocessor

- Calculators
- Accounting system
- Games machine
- Complex industrial controllers
- Traffic light
- Control data
- Military applications
- Defense systems

Applications of Microcontroller

- Mobile phones
- Automobiles
- CD/DVD players
- Washing machines
- Cameras
- Security alarms
- Keyboard controllers
- Microwave oven