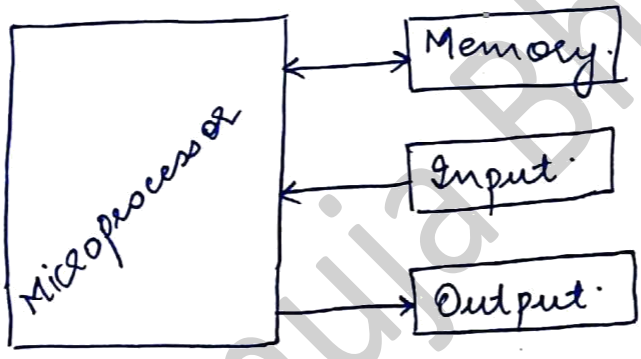
Microprocessor :-

- A microprocessor is a multipurpose, programmable, clock driven, register based electronic device that reads binary instruction from a storage device called Memory, accepts binary data as input and processes data according to those instructions, and provide result as output.
- A typical programmable machine can be represented with four components : Microprocessor, Memory, Input & Output.



- Example of programmable machine
  - → Turn traffic light ON / OFF.
  - → Compute mathematical function
  - → Washing Machine, Dish washer
  - → Dashboard Controls

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- **Memory** - is like the page of Notebook with space for fixed number of binary number on each line. These pages are made of semiconductor Material. Typically, each line is an 8-bit register that can store eight binary bits and several of these registers are stored in a sequence called memory. These registers are always group together in power of two.

  Example: A group of 1024 (2^{10}) 8 bit register on a semiconductor chip is known as 1K byte of memory.

- **History**

Processor	Year	Transistor Used	Clock Speed	Address Bus	Data Bus
8085	1976	6500	5 MHz	16-bit	8-bit
8086	1978	29000	5 MHz	20-bit	16-bit

- Why Name as 8085 ?
  → Generated in 1976 (80)
  → Processor is 8-bit
  → Work at 5 Volt

- Why 8086 ?
  → Next version of 8085.

- Memory stores binary information as instructions and data and provides that information to the processor whenever necessary.
- Memory has two sections
  - → ROM (Read Only Memory)

    It is used to store programs that do not need alterations. This program interprets the information entered through keyboard and provide equivallent binary digit to microprocessor.
  - → RAM (Random Access Memory)

    It is used to store user programs and data. The information stored in this memory can be easily read and altered.
- Input / Output :- It communicate with outside world also known as peripherals.
- System - Bus - It is a communication path between microprocessor and peripherals. It is nothing but a group of wires to carry bits. All peripherals share the same bus, the microprocessor communicates with one peripheral at a time.

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• How does microprocessor work?

→ The instructions are stored sequentially in the memory.

→ The microprocessor fetch the first instruction from the Memory, decodes it and executes that instruction.

→ The sequence of fetch, decode and execute is continue until the microprocessor come across an instruction to stop.

→ During the entire process, the microprocessor uses the system bus to fetch the binary instructions and data from memory.

→ It uses register to store data and perform computing function in ALU.

→ Finally, it sends the result in binary, using the same bus lines, to the seven segment LED's.

• ASCII Code.

→ A computer is a binary machine, to communicate with computer in alphabetic letters and decimal numbers translation code are necessary.

→ The commonly code is known as ASCII - American Standard Code for Information Interchange.

→ It is a 7-bit code with 128 (2^7) combinations. and each code is assigned as letter, alphabet, decimal number or symbol.

Evolution of Microprocessor :-

- The history of microprocessor starts from 1971. The first µP launched by Intel in 1971 i.e Intel 4004, a 4-bit microprocessor.
- The 4004 consist of ALU and control unit. It provides only 45 instructions. It is a 16 pin dual in-line package integrated circuit.
- After 4004 various other 4 bit microprocessor are launched in the market by other manufactures. eg Intel 4040, Rockwell International PPS4, Toshiba T3472.
- In 1972, the first 8 bit microprocessor, 8008, launched by Intel. After this, 8080, 8 bit µP is introduced which is enhanced version of 8008. These are designed by using PMOS technology. These
- are basically first generation µP.
- After 1973, the second generation processor, known as 8 bit µP such as Motorola 6800, & 6809, Intel 8085, Zilog Z80 and Fairchild F8 are launched by different manufacturers. These are designed by using NMOS technology.

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Microprocessor Name	Manufacturer	Distinction
4004	Intel	First μp (1971)
8008	Intel	First 8-bit μp (1972)
8080 A	Intel	First n-channel, second generation μp (1974)
6800	Motorola	First +5V only μp (1974)
PACE	National Semiconductor	First 16-bit μp (1974)
1802	RCA	First CMOS μp (1974)
8048	Intel	First 8-bit single-chip Microcomputer (1976)
8088	Intel	First 8-bit processor with 16-bit internal architecture (1979)
80386	Intel	First 32-bit μp (1982)
Pentium	Intel	First 64-bit μp (1993)

- After 1978, the third generation µp known as 16-bit microprocessor are came into the market.

eg Intel 8086, Motorola M68000, Zilog's Z8000,

- These µp were designed using High Density MOS technology. The HMOS is four times faster than NMOS.

- After 1980, fourth generation µp known as 32-bit, 64 bit microprocessor are launched.

Application of Microprocessor :-

1. Microprocessor Based Dedicated Controllers

→ The dedicated controller is designed to control some physical parameters like temperature, pressure, level, displacement etc.

→ This system is preprogrammed system i.e user cannot change the program. In this system, the user can set only parameters, not program. The program is stored in non-volatile memory like ROM.

eg Motor speed controller, elevator controller, traffic-light controller, security & fire alarms

Home appliances like water heater, microwave oven, video games

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2. Work Stations

→ It is usually 16 or 32 bit µp based system.

eg 3D Graphics

3. Communication System

→ µp can be used in data communication.

eg Serial to parallel and parallel to serial data transfer signal processing.

4. Automobile

→ µp is also used in automobile.

eg Ignition control, Control panel.

5. Medical

→ µp is used in many medical instruments.

eg X - Ray Machine, ECG Machine, pathological labs etc.

6. Instruments

→ µp is used in testing and measuring instruments to control all the functions.

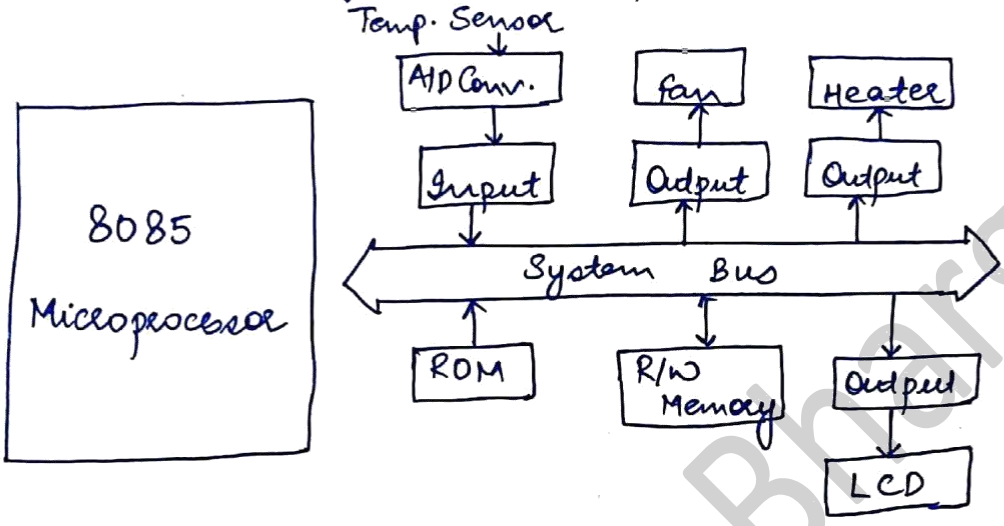
eg CRO, Signal Generator, Power Supply, Touch Screen

7. Replacement of Random logic

→ Any random logic circuit like combinational and sequential can be replaced by the µp.

Application : Microprocessor Controlled Temperature System

- This system is expected to read the temperature in a room, display the temperature at liquid crystal display (LCD) panel, turn on the fan if the temperature is above a set point, and turn on heater if the temperature is below a set point.



- To design such system,
  - → one input device (to sense room temperature)
  - → three output device (Fan, Heater, LCD display)

- Microprocessor

  It will read the binary instructions from memory and execute those instructions continously.

  It will read the temperature, display it at the LCD display panel and turn ON/OFF the fan and heater based on the temperature.

- Memory

The system includes two types of Memory.

ROM (Read Only Memory) will be used to store the programs, that is responsible for providing the necessary instructions to the processor to Monitor the system.

The R/W Memory is needed for temporary storage of data.

- Input

In this system, a device is required that translate temperature into equivallent electrical signal. A temperature sensor is a three terminal semiconductor device that generates a voltage signal proportional to the temperature. Since, it is an analog signal. Therefore Analog to Digital convertor is used to convert signal into digital bits.

- Output

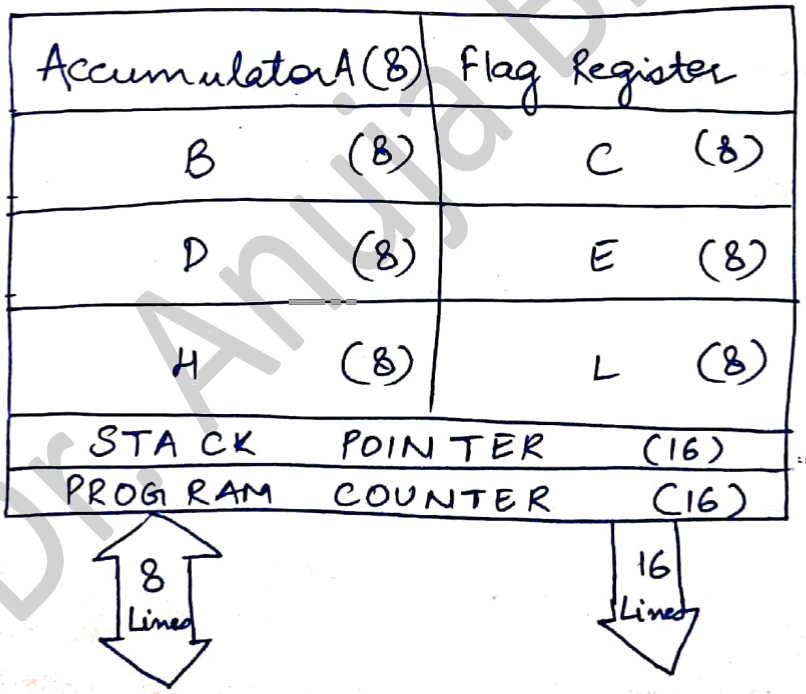
FAN - It is turned ON by the processor when the temperature reaches at high limit.

HEATER - It is turned ON by the processor when the temperature reaches at lower limit.

LCD - Liquid Crystal Display can display letters, decimal digits, or graphic characters.

8085 Programming Model

- Programming Model (Information needed to write programs)
- The programming model does not reflect the physical structure of 8085 but includes the information that is critical in writing assembly language programs.
- The model includes six registers, one accumulator and one flag register. It has two 16 bit registers: stack pointer and program counter.



• Registers

→ The 8085 has six general purpose registers to store 8- bit data identified as, B, C, D, E, H & L.

→ They can be combined as register pairs - BC, DE & HL, to perform some 16 bit operations.

→ The programmer can use these registers to store or copy data into registers.

• Accumulator

→ The accumulator is an 8- bit register that is part of arithmetic / logic unit (ALU).

→ This register is used to store 8- bit data and to perform arithmetic and logical operations.

→ The result of operation is stored in the accumulator.

→ The accumulator is also identified as register A.

• Flags

→ The ALU includes five flip- flops, which are set or reset according to operation.

→ The bit position in flag register is as shown.

D_7	D_6	D_5	D_4	D_3	D_2	D_1	D_0
S	Z		AC		P		CY

→ Z - Zero : The zero flag is set to one when the result is zero, otherwise it is reset.

→ CY - Carry : If an arithmetic operation results in a carry, the CY flag is set ; otherwise it is reset.

→ S - Sign : The sign flag is set if bit $D_7 = 1$, otherwise it is reset.

→ P - Parity : If the result has even number of 1's, the flag is set ; for an odd number of 1's, the flag is reset.

→ AC - Auxillary Carry : In an arithmetic operation, when carry is generated by digits D_3, and passed to digit D_4, the AC flag is set.

• Program Counter (PC) :

→ The size of this register is 16 bit because the memory address is of 16 bits.

→ The PC points to the memory address from which instruction has to be fetched.

→ The SP points to memory location in R/W memory, called the stack.

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