MICROPROCESSORS & PROGRAMMING

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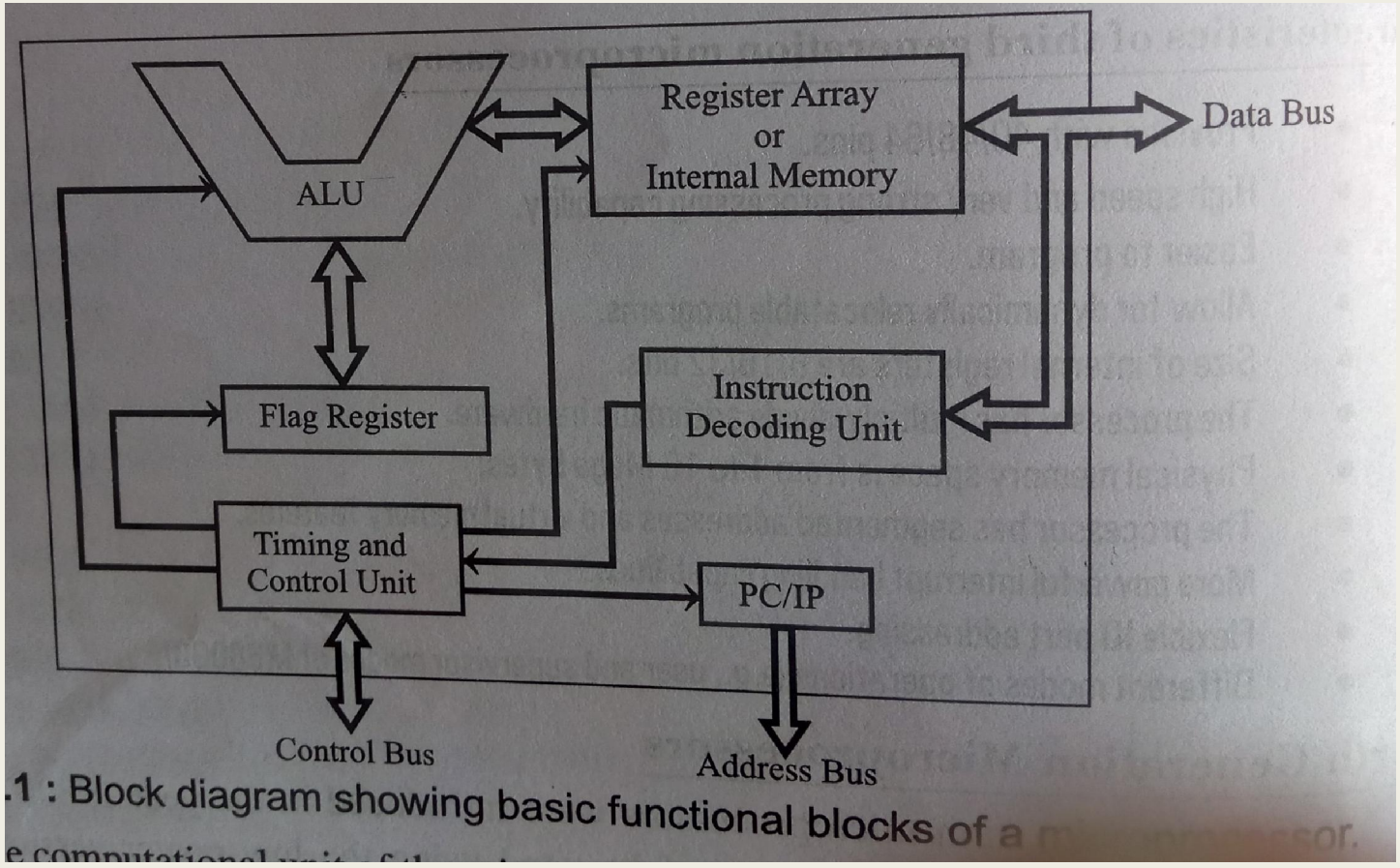
intel
pentium 4

Basic functional blocks of a microprocessor

- A microprocessor is a programmable IC which is capable of performing arithmetic and logic operations.



.1 : Block diagram showing basic functional blocks of a

- ALU:- is the computational unit of the microprocessor which performs arithmetic and logical operations on binary data
- The various conditions of the result are stored as status bits called flags in the flag register
  - *Sign flag:- is used to store the status of the sign of the result of the ALU operation. If the result is negative then '1' is stored in the sign flag and if the result is positive then '0' is stored*
- The register array is the internal storage device and so it is called internal memory. The input data for ALU, the output data of ALU and any other binary information needed for processing are stored in the register array
- For any microprocessor, there will be a set of instructions given by its manufacturer. Programs using these instructions and store them in a memory device external to the microprocessor

- The instruction pointer generates the address of the instructions to be fetched from the memory and sends it through the address bus to the memory
- The memory will send the instruction codes and data through the data bus
- The instruction codes are decoded by the decoding unit and it sends information to the timing and control unit
- The data is stored in the register array for processing by the ALU
- The control unit will generate the necessary control signals for internal and external operations of the microprocessor

Microprocessor based systems

- A microprocessor is a semiconductor device manufactured by the VLSI technique.
- It includes the ALU, register arrays and control circuit on a single chip
- To perform a function or useful task, we have to form a system by using the microprocessor as a CPU and interfacing memory, the input and output devices to it.
- A system designed using a microprocessor as its CPU is called a microcomputer or single board microcomputer.
- A microprocessor-based system consists of a microprocessor as the CPU, semiconductor memories like EPROM and RAM, an input device, an output device and interfacing devices
- The memories, input device, output device and interfacing devices are called peripherals

Block diagram

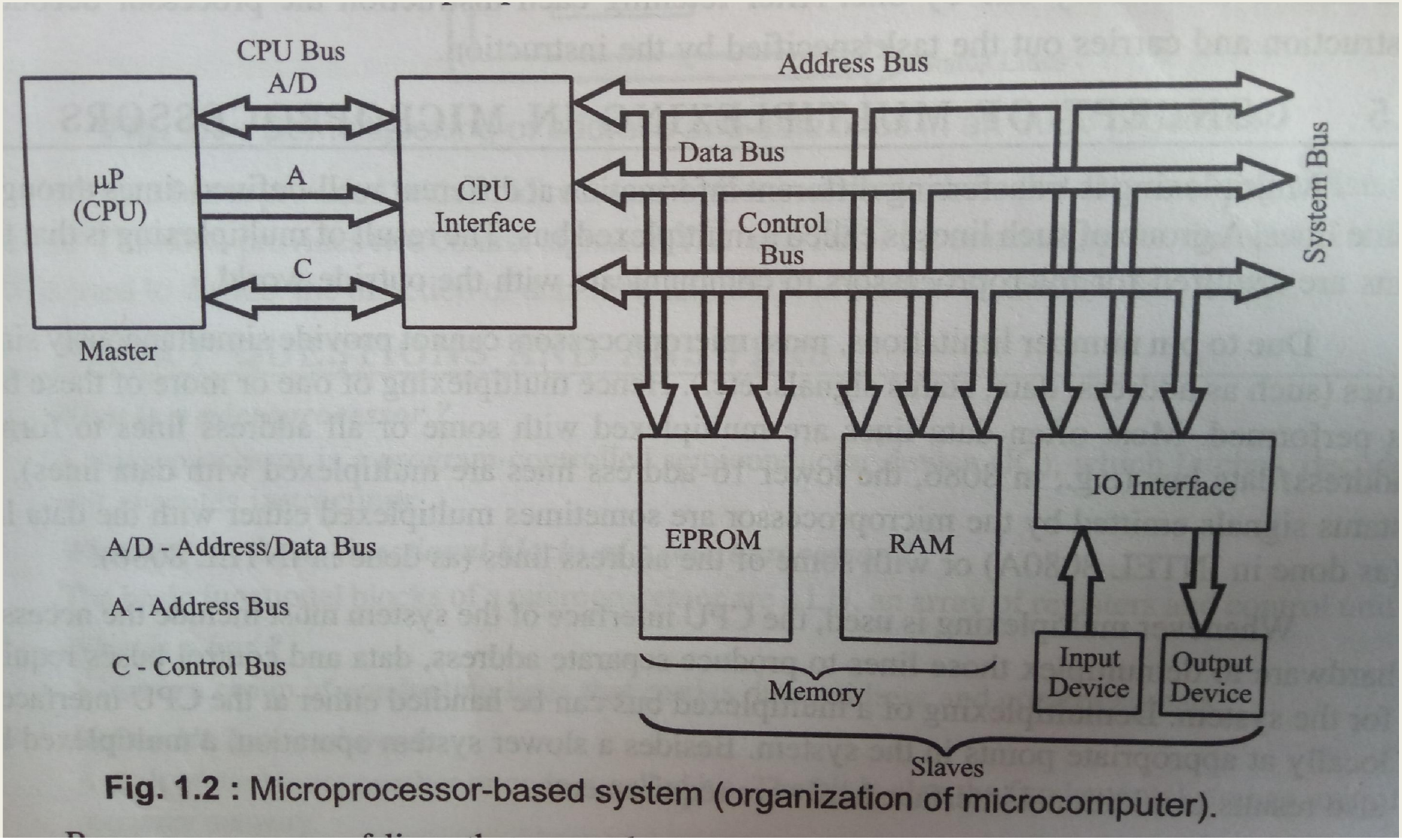


Fig. 1.2 : Microprocessor-based system (organization of microcomputer).

- Microprocessor is the master and all other peripherals are slaves
- The master controls all the peripherals and initiates all the operations
- Buses are a group of lines that carry data, address or control signals
- The CPU interface provided to demultiplex the multiplexed lines, to generate chip select signals and additional control signals.
- The system bus has separate lines for each signal
- All the slaves are connected to the same system bus
- At any time instant communication takes place between the master and one of the slaves
- All the slaves have tristate logic and hence normally remain in a high impedance state.

- In tristate logic, three logic levels are used, high, low and high impedance state.
- The high and low are normal logic levels and high impedance state is an electrical open-circuit condition.
- The tristate devices will normally remain in high impedance state and their pins are physically connected in the system bus but electrically isolated.
- The EPROM memory is used to store permanent programs and data.
- The RAM memory is used to store temporary programs and data
- The I/P is used to enter program and data
- The O/P is used for examining results
- Since the speed of the I/O devices doesnot match with the speed of the microprocessor, an interface is provided

- The work done by the processor can be classified as
  - ***Work done internal to the processor:*** *Add, subtract, data transfer etc*
  - ***Work done external to the processor:*** *R/W from/to i/o or memory or peripherals*
  - ***Operations initiated by the slaves or peripherals :*** *interrupt master*
- To execute a program, the microprocessor issues address and control signals to fetch the instruction and data from memory one by one.
- After fetching each instruction, the processor decodes the instruction and carries out the task specified by the instruction