MICROCONTROLLER

Computer: A computer is a multipurpose programmable machine that reads binary instructions from its memory , accepts binary data as input ,processes the data according to those instructions and provides results as output. It is a programmable device made up of both *hardware* and *software*. The various components of the computer are called *hardware*. A set of instructions written for the computer to solve a specific task is called program and collection of programs is called *software* .

The computer hardware consists of four main components. The central processing unit which acts as computer‘s brain. Input unit through which program and data can be entered to computer, output unit on which the results of the computations can be displayed. Memory in which data and programs are stored.

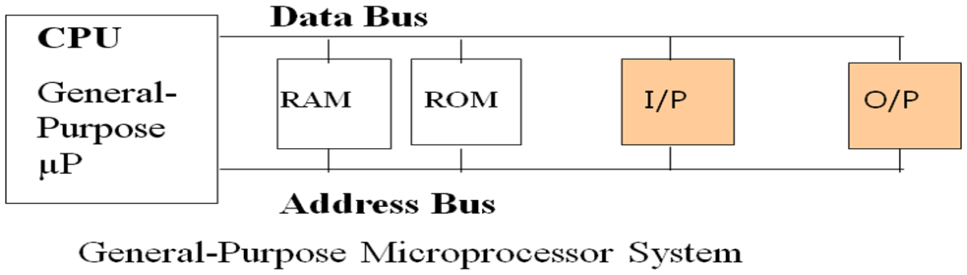

Fig 1. Block diagram of a microcomputer

A computer that is designed using a microprocessor as its CPU , is known as a microcomputer.

Microprocessor or _Computer on Chip‘ first became a commercial reality in 1971 with the introduction of the 4 bit 4004 by Intel. A byproduct of Microprocessor development was Microcontroller. The same fabrication technology and programming concept that make the general purpose microprocessor also yielded the Microcontroller.

Microprocessors:

A microprocessor is a general purpose digital computer central processing unit (CPU). Although known as a _Computer on Chip‘ the Microprocessor in no sense a complete digital computer. Block diagram of a Microprocessor CPU which contains ALU; Program counter (PC), a stack pointer (SP) ,some working registers , a clock timing circuit and interrupt circuit s is shown in the following figure

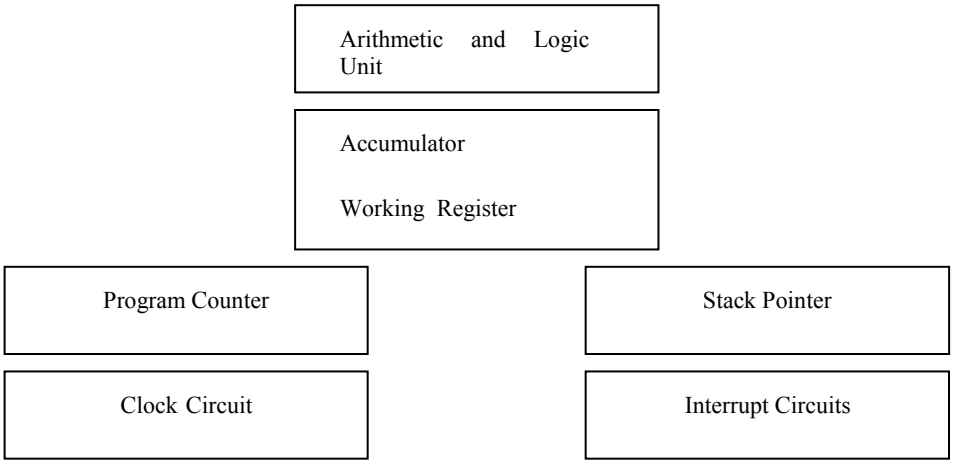

Fig.2.Block Diagram of a Microprocessor

To make a computer microcomputer one must add memory usually RAM and ROM, memory decoders , an oscillator and a number of Input ,Output devices such as serial and parallel ports. In addition special purpose devices such as interrupt handler and counters may be added to relieve the CPU from time consuming counting or timing cores. When the Microcomputer is equipped with mass storage devices , I/O peripherals such

as a key board and a display CRT it yields a small computer that can be applied to a range of general purpose applications.

The hardware design of a microprocessor is arranged such that a very small or very large system can be configured around the CPU as the application demands as shown in Fig1. The prime use of the Microprocessor is to read data , perform extensive calculations on that data, and store those calculations in a mass storage device or display the results for human use. The programs used by microprocessor are stored in the mass storage device and loaded into RAM as user directs. A few microprocessor program are stored in ROM . The ROM based programs are primarily small fixed programs that operate peripherals and other fixed devices that are connected to the system.

Microcontroller: A Microcontroller is a programmable digital processor with necessary peripherals. Both microcontrollers and microprocessors are complex sequential digital circuits meant to carry out job according to the program / instructions. Sometimes analog input/output interface makes a part of microcontroller circuit as mixed mode(both analog and digital) in nature.

A microcontroller can be compared to a Swiss knife with multiple functions incorporated in the same Integrated Circuits. Block diagram of a typical Microcontroller which is a true computer on a chip is shown below. The design incorporates all the features found in microprocessor CPU : ALU,PC, SP and registers. It also has other features needed to make a complete computer: ROM, RAM, Parallel I/O, serial I/O, Counters and clock circuits. Like the microprocessor , a microcontroller is a general purpose device, but one that is meant to read data, perform limited calculations on that data and control its environment based on those calculations. The prime use of microcontroller is to control the operation of a machine using a fixed program that is stored in ROM and that does not change over the lifetime of the system.

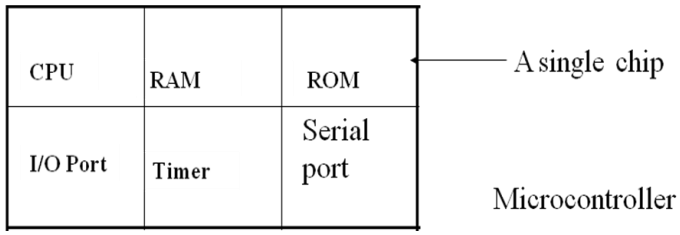

Fig3. Block diagram of a single chip computer

Complex Instruction Set Computer (CISC):

Memory in those days was expensive. Bigger programs required more storage which included more money . There was a need to reduce the number of instructions per program . This was achieved by having multiple operations within single instruction. Multiple operations lead to many different kinds of instructions .Access to memory in turn makes the instruction length variable and fetch-decode execute time unpredictable – making it more complex. Thus hardware was made to understand the complexity of instruction set. The computer having such instruction set was named as Complex Instruction Set Computer (CISC). Intel 8051 is an example for CISC architecture.

Reduced Instruction Set Computer (RISC):

In applications which require more of input , output related operations having few simple instructions that are of the same length allows memory access only with explicit load and store instructions. Hence each instruction performs less work but instruction execution time among different instructions is consistent.

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This would lead to instruction execution by hardware including multiple number of registers inside CPU. The computer using such instructions is called Reduced Instruction Set Computer (RISC). PIC microcontroller manufactured by Microchip Company is an example for RISC architecture.

Source : http://elearningatria.files.wordpress.com/2013/10/ece-iv-microcontrollers-10es42-notes.pdf