Difference Between Micro Processor and MicroController

MicroProcessor	MicroController
1.MicroProcessor is only a processing unit which is quite powerful in terms of computing.	1.MicroController contains processing unit along with small amount of memory and I/O components .
2.It is the heart of the Computer System.	2.It is heart of an embedded system.
3.Memory and I/O has to be connected externally,So the circuit becomes large.	3.Memory and I/O are already present, and the internal circuit is small.
4.It cannot be used in compact systems.	4.It can be used in compact systems.
5.Cost of entire system is high.	5.Cost of entire system is low.
6.Total power consumption is high due to external components.	6.Total power consumption is low.
7.Most of the microprocessors do not have power saving features.	7.Most of the microcontrollers has power saving features.
8.Microprocessor has a smaller number of registers, so more operations are memory-based.	8.It has more register.Hence the programs are easier to write.
9.Microprocessors are based on Von Neumann model.	9.It is based on Harvard architecture.
10.It can run at a very high speed because of the technology involved.	10.Microcontroller based systems run up to 200MHZ or more depending on the architecture.
11.It’s used for general purpose applications that allows to handle loads of data.	11.It’s used for application-specific systems.
12.examples:ARM,cortex-A series etc.	12.examples:ARM,cortex-M series,Intel8051 etc.

Types Of MicroControllers

Microcontrollers are classified into different types on various basis:

1. On the basis of Bus width

2. On the basis of Memory

3. On the basis of Instruction set architecture

1. On the basis of Bus width

The bus in a microcontroller transmits the instruction and data between the CPU, memory and input/output ports.There are three types of buses inside a microcontroller data bus,address bus,control bus.

On the basis of Bus width the microcontrollers are divided into:

A.8-bit Microcontroller

- The bus width of such microcontroller is 8 bit.It means it can transfer and process the data of 8 bits in a single cycle. Inorder to process a large data for example 16 bits, it uses multiple cycles to complete a simple mathematical function. It results in a poor performance of the overall logic circuit.
- Some of the common 8 bit microcontrollers are Intel 8031/8051 ,PIC1x.

B.16-bit Microcontroller

- The bus width of such microcontroller is 16 bit.It can transfer and process a data of 16 bits in a single cycle.It is more efficient in performance comparing to 8-bit microcontroller.
- Examples:8051XA,PIC2X,Intel 8096.

C.32-bit Microcontroller

- It has bus width of 32 bits.The performance and accuracy of such microcontroller is higher than 16-bit microcontroller but they are also expensive and consume a lot of power.

- Its higher processing speed makes it the best candidate for performing a complex tasks such as audio and video signal processing etc.
- The common 32 bit microcontrollers are Intel/Atmel 251 family.

2. On the basis of Memory

The microcontroller is classified into two types on the basis of memory:

A. Embedded Memory Microcontroller:

- This type of microcontroller has all the essential memory blocks or modules inside a single package.
- Some of these functional blocks are program and data memory ,Timers , counters,interrupts etc.
- These memory blocks are fixed and not expendables but a microcontroller having the feature of external ROMs can extend its storage memory.

B. External Memory Microcontroller:

- It does not have one of the essential memory blocks inside its chip and it needs to be connected externally to function properly.
- The use of external modules increases the size of the overall device.

3.On the Bais of Instruction set Architecture

Instruction set architecture is a part of microcontroller that commands the microprocessor to perform a specific function. The instruction set includes addressing modes,instructions,data types,registers,interrupts and external I/o.

A. Complex Instruction set computer

- This type of microcontroller's CPU is designed to execute a single complex command.
- It can execute multiple instructions or steps using a single instruction.
- The advantage of CISC microcontroller is its small-sized program.

- But due to the large size of its instruction set with many addressing modes, it takes a multiple machine cycle to execute & causes longer time to perform.
- Another problem is the parallel execution of an instruction which is not possible in CISC.

B. Reduced Instruction set Computers

- This type of microcontroller's CPU is designed to execute smaller simpler instructions.
- Since it takes one machine cycle to execute a single instruction.
- Its instruction set size is small.
- The program code written will be usually very lengthy and consists of many lines.