**Following are the important features of microcontroller 8051:**

1. It provides many functions (CPU, RAM, ROM, I/O, interrupt logic, timer, etc.) in a single chip.

2. 8-bit CPU With registers A (Accumulator) and Register B

3. 8-bit Program Status Word (PSW)

4. 8-bit Stack Pointer

5. 16-bit Program Counter (PC) and Data Pointer (DPTR)

6. 8-bit data bus - It can access 8 bits of data in one operation (hence it is an 8-bit microcontroller)

7. 16-bit address bus - It can access 216 memory locations - 64 kB each of RAM and ROM

8. On-chip RAM - 128 bytes ("Data Memory")

9. On-chip ROM - 4 kB ("Program Memory")

10. Four byte (32 Bits) bi-directional input/output port i.e. PO - P3 (xi) UART (serial port)

11. Two 16-bit timers/Counter; TO - Tl

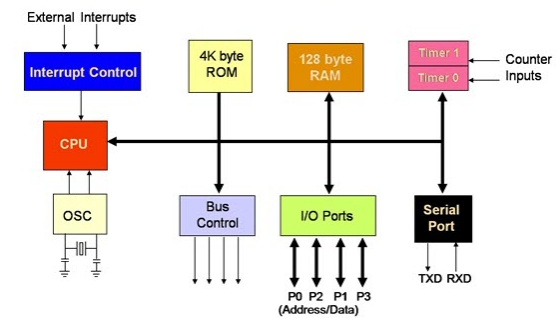
12. Two External and three internal Interrupt Sources

13. Two-level interrupt priority

14. Power saving mode

**8051 Microcontroller Architecture**

Let's see the internal architecture of 8051 Microcontroller represented in form of block diagram as shown below:



Basic components present internally inside 8051 Microcontroller architecture are:

**CPU** (Central Processing Unit): CPU act as a mind of any processing machine. It synchronizes and manages all processes that are carried out in microcontroller. User has no power to control the functioning of CPU. It interprets the program stored in ROM and carries out from storage and then performs it projected duty. CPU manage the different types of registers available in 8051 microcontroller.

**Interrupts**: Interrupts is a sub-routine call that given by the microcontroller when some other program with high priority is request for acquiring the system buses the n interrupts occur in current running program. Interrupts provide a method to postpone or delay the current process, performs a sub-routine task and then restart the standard program again.

Types of interrupt in 8051 Microcontroller:

* Timer 0 overflow interrupt - TF0
* Timer 1 overflow interrupt - TF1
* External hardware interrupt - INT0
* External hardware interrupt - INT1
* Serial communication interrupt - RI/TI

**Memory**: For operation Micro-controller required a program. This program guides the microcontroller to perform the specific tasks. This program installed in microcontroller required some on chip memory for the storage of the program. Microcontroller also required memory for storage of data and operands for the short duration. In microcontroller 8051 there is code or program memory of 4 KB that is it has 4 KB ROM and it also comprise of data memory (RAM) of 128 bytes.

**Bus** : Bus is a group of wires which uses as a communication canal or acts as means of data transfer. The different bus configuration includes 8, 16 or more cables. Therefore, a bus can bear 8 bits, 16 bits all together.

Types of buses in 8051 Microcontroller:

* Address Bus: 8051 microcontrollers is consisting of 16 bit address bus. It is generally be used for transferring the data from Central Processing Unit to Memory.
* Data bus: 8051 microcontroller is consisting of 8 bits data bus. It is generally be used for transferring the data from one peripherals position to other peripherals.

**Oscillator**: As the microcontroller is digital circuit therefore it needs timer for their operation. To perform timer operation inside microcontroller it required externally connected or on-chip oscillator. Microcontroller is used inside an embedded system for managing the function of devices. Therefore, 8051 uses the two 16 bit counters and timers. For the operation of this timers and counters the oscillator is used inside microcontroller.

**Memory organisation in 8051 microcontroller:**

8051 microcontroller memory is divided into program memory and data memory. Program memory Rome is used for saving program being executed while data memory ram is used for temporarily storing and keeping internal results and variables.

**Program memory**

* Program memory is used for permanently saving program or code being executed the memory is read only and non volatile
* Depending upon the settings made in the compiler program memory may also b used to store constant variables. 8051 executes program stored in program memory only
* On chip room of 8051 is 4 KB
* Program memory Max limit is 64 KB
* Lowest 4 kilobytes of program memory can either be on chip room or in an external room.
* This selection of internal or external code memory depends upon east a enable access logic state.
* If logic one is applied to enable access pin then program is directory to internal ROM in this case a program from baked in ROM is to be executed first afterwards the execution is continued by reading additional memory.
* If logic zero is applied to enable access pin then all programs fetches are directed to external room in this case internal program memory is completely ignored and only program stored in external memory is executed
* In normal operation the code from internal memory will be Picked up from 0000 H to 0FFF H . And also the external memory is executed from location 1000 H to FFFF H.
* Dick sternal program memory address is always 16-bit address. If the memory is very small compare to 60 4KB memory then also the address will be 16-bit. So when we use the external memory we cannot use port one and port 2 as input output ports.

**Data memory**

* Data memory is used for temporary Lee storing data and intermediate results created during the operation of the micro controller.
* Data memory needs to be read and written but the information stored does not need to be preserved. Once micro controller has been powered off so it is also known as volatile memory.
* Original 8051 micro controller from Intel had 128 bit RAM.
* The internal data memory is divided into three blocks:

1. Registered banks:

* The first 32B that is from address 00H to 1FH consist of 32 working registers that are organised as four banks with eight registers in each bank.
* Dividing the registers into register banks helps in utilising memory efficiently. It allows you to address entire range of memory using just a register name.
* The four banks are named banks zero, bank one, bank to and bank three. Each bank consist of eight registers named R0 to R7. Each resistor can be addressed in two ways by name or by address.
* To address the register by name first, corresponding bank must be selected in order to select the bank. We have to use RS0 and RS1 bits of program status word register PSWR.
* When addressing the register using address corresponding bank may or may not be selected.

1. Bit addressable area:

* It consist of 16 bit addressable registers that means each beat in this block has its own address.
* These beds can be addressed as 00H to 7FH or as 20.0 to 2F.7.
* Each location can also be addressed as byte.
* These bits can be individually, set, cleared, compared and and or etc. With Carrie pet using bit manipulation instructions.

1. General-purpose register or scratchpad:

* rest of the Ram from 30 H to 7FH having 80 general-purpose registers, these 80 bytes can be addressed directly or indirectly using direct or indirect addressing Motes respectively. Therefore, it is also called scratch card memory. You may read or write full bite data from these locations.

1. In addition, there are SF fives in address range 80 H to FF H. These address ranges actually given 128 addresses, but only 32 are used by 8051.