BASIC OPERATIONAL CONCEPTS OF COMPUTER

To perform a given task an appropriate program consisting of a list of instructions is stored in the memory. Individual instructions are brought from the memory into the processor, which executes the specified operations. Data to be stored are also stored in the memory.

Examples: - Add LOCA, R_0

This instruction adds the operand at memory location LOCA, to operand in register R_0 & places the sum into register. This instruction requires the performance of several steps,

1. First the instruction is fetched from the memory into the processor.
2. The operand at LOCA is fetched and added to the contents of R_0
3. Finally the resulting sum is stored in the register R_0

The preceding add instruction combines a memory access operation with an ALU Operations. In some other type of computers, these two types of operations are performed by separate instructions for performance reasons.

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Load   LOCA, R1
Add    R1, R0
```

Transfers between the memory and the processor are started by sending the address of the memory location to be accessed to the memory unit and issuing the appropriate control signals. The data are then transferred to or from the memory.

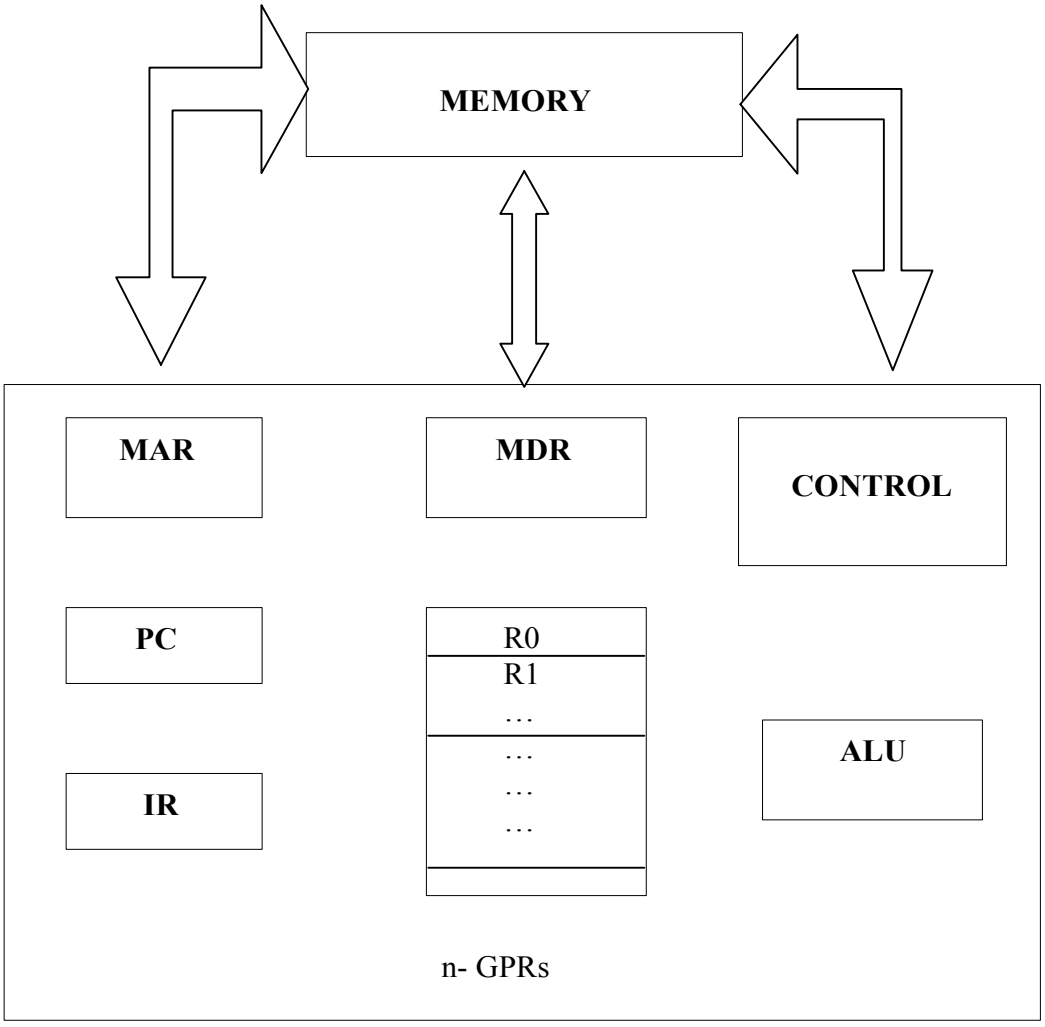

Fig b : Connections between the processor and the memory

The fig shows how memory & the processor can be connected. In addition to the ALU & the control circuitry, the processor contains a number of registers used for several different purposes.

The instruction register (IR):- Holds the instructions that is currently being executed. Its output is available for the control circuits which generates the timing signals that control the various processing elements in one execution of instruction.

The program counter PC:-

This is another specialized register that keeps track of execution of a program. It contains the memory address of the next instruction to be fetched and executed.

Besides IR and PC, there are n-general purpose registers R0 through R_{n-1}.

The other two registers which facilitate communication with memory are: -

1. **MAR – (Memory Address Register):-** It holds the address of the location to be accessed.
2. **MDR – (Memory Data Register):-** It contains the data to be written into or read out of the address location.

Operating steps are

1. Programs reside in the memory & usually get these through the I/P unit.
2. Execution of the program starts when the PC is set to point at the first instruction of the program.
3. Contents of PC are transferred to MAR and a Read Control Signal is sent to the memory.
4. After the time required to access the memory elapses, the address word is read out of the memory and loaded into the MDR.
5. Now contents of MDR are transferred to the IR & now the instruction is ready to be decoded and executed.
6. If the instruction involves an operation by the ALU, it is necessary to obtain the required operands.
7. An operand in the memory is fetched by sending its address to MAR & Initiating a read cycle.
8. When the operand has been read from the memory to the MDR, it is transferred from MDR to the ALU.
9. After one or two such repeated cycles, the ALU can perform the desired operation.
10. If the result of this operation is to be stored in the memory, the result is sent to MDR.
11. Address of location where the result is stored is sent to MAR & a write cycle is initiated.
12. The contents of PC are incremented so that PC points to the next instruction that is to be executed.

Normal execution of a program may be preempted (temporarily interrupted) if some devices require urgent servicing, to do this one device raises an Interrupt signal.

An interrupt is a request signal from an I/O device for service by the processor. The processor provides the requested service by executing an appropriate interrupt service routine.

The Diversion may change the internal stage of the processor its state must be saved in the memory location before interruption. When the interrupt-routine service is completed the state of the processor is restored so that the interrupted program may continue.

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