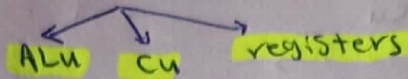


Micro-processor:-

It is an Integrated circuit (IC).

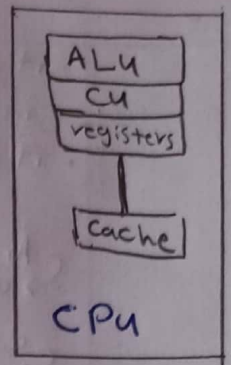
it is consist of CPU only.

it is composed of:-



it is called:-

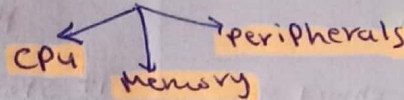
- Micro processor (MP)
- Micro Processing unit (MPU)
- Central processing unit (CPU)



Micro controller:-

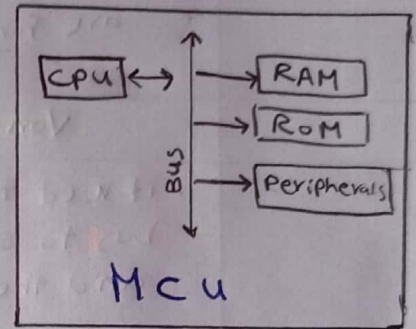
It is an integrated circuit.

It is composed of:-



it is called:-

- Micro controller (MC)
- Micro controller unit (MCU)

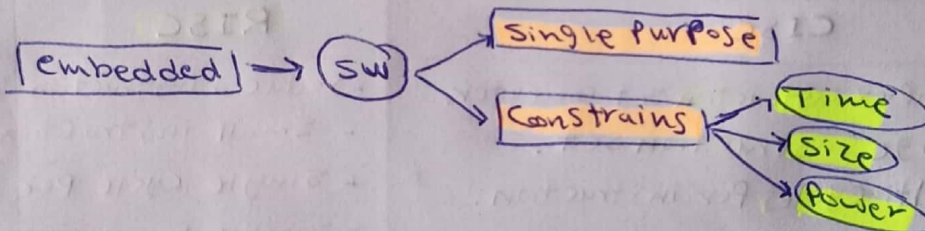


Embedded systems:-

it is a special purpose computer used

to do a one or a few tasks with

real-time constraints.



Mechatronic systems:-

it is the system in which mechanical hardware are integrated with information-driven systems like as micro controller.

n-bit processor:-

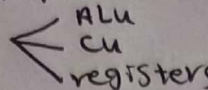
- it is the number of bits of data which can be processed by the CPU at the same time.

- it is the number of data lines which are fed to the CPU,

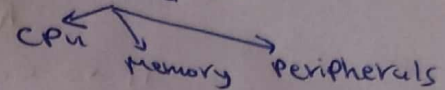
- an n-bit CPU means that its ALU operates on n-bit data word per clock cycle.

- A Processor with an n-bit register can address up to (2^n) addresses.

micro-Processor

- it merge all Functions of CPU in a single chip.
- it composed of 
 - ALU
 - CU
 - registers
- Arithmetic logic unit (ALU)
 - used to Perform Calculations
- Control unit (CU)
 - used to decode instructions
- registers
 - it is a small, fast storage are for data & instructions

micro Controller

- it is a small Computer used to Perform specific task
- it composed of 
 - CPU
 - Memory
 - Peripherals
- all of this are on a single chip.

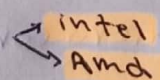
Von-Neumann

- it used the same memory and bus to store the data & and the instruction.
- We can't Fetch instruction and Store data for another instruction at the same time.
- it used in Computers & PCs.

Harvard

- it store instruction & data in separate memory and use different busses to access them.
- We can Fetch instruction and Store data for another instruction at the same time.
- it used in MCU & SOC

CISC

- Complex instruction set Computer.
- large instruction set.
- Multi cycles per instruction.
- Complex hardware.
- expensive.
- used in laptops & Computers.
- made by 
 - intel
 - Amd

RISC

- reduced instruction set Computer.
- Small instruction set.
- Single cycle per instruction.
- Simple hardware.
- cheaper
- used in Smart Phones.
- based on Arm processor

RAM

- Random Access Memory
- Volatile memory
- Fast
- Small

SRAM

DRAM

- Based on MosFet
- Read / write memory.

ROM

- Read only memory
- non-volatile memory
- Slow
- large

EPROM

PROM

Masked ROM

- Based on Floating gate MosFet
- Read only memory.

ROM (Read only Memory)

PROM

- it is a blank memory when it manufactured.
- it can be programmed by the user.
- it is programmed by burner.
- the data store in it cannot be deleted or modified.
- it is OTP (one-time programmable)

Programmable ROM

Masked ROM

- it is programmed during the manufacturing it by the IC-manufacturer.
- the data store in it cannot be deleted or modified.
- cheaper
- it is OTP (one-time Programmable)

EPROM

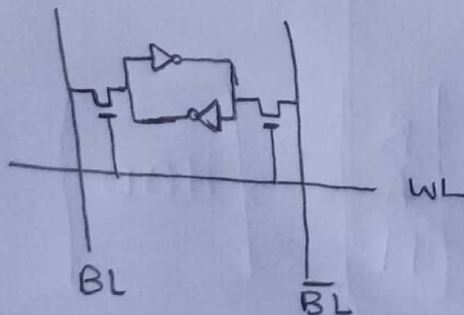
- it can be programmed many times.
- we use UV-EPROM to delete the contents of EPROM.
- we can't use electrical signals to delete its content.
- we can't delete a particular part of data, all data is deleted.

Erasable PROM

RAM (Random Access Memory)

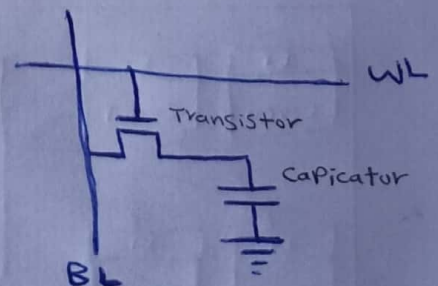
SRAM

- Static Random Access memory
- bit carrier consists of 6T
- it is Volatile memory.
- Data access in it is faster than DRAM.
- it does not require refreshing time to save its content.
- it works by inverse feedback
- it is expensive
- it has more complex design.
- we can access data at any time.



DRAM

- Dynamic Random Access Memory.
- bit carrier consists of 1T & 1C
- it is Volatile memory
- Data access is faster than Flash
- it requires refreshing time to save its content (64 ms)
- it is cheap.
- we cannot access the data when DRAM is refreshed.



Hybrid

EEPROM

- it is non volatile memory
- can be connected serial by I2C, SPI, ...
- it is reprogrammable
- we can delete data by electrical signals.

electrical erasable
Programmable ROM

Flash

- it is:
 - high density
 - low cost
 - non volatile
 - Fast
 - reprogrammable by electrical signals

NVRAM

- it is a:
 - SRAM + battery backup
non volatile
very expensive
data access is fast
we use lithium battery.
 - SRAM + EEPROM
non volatile

Non-volatile
RAM

Why ROM is read only Memory although I can write on it??

because in the normal operations, the CPU does not have the capability to write to ROM.

but we can write on it by external device (burner).

or there is a special configuration within the system wherein the CPU is granted access to write on ROM.

L1 cache

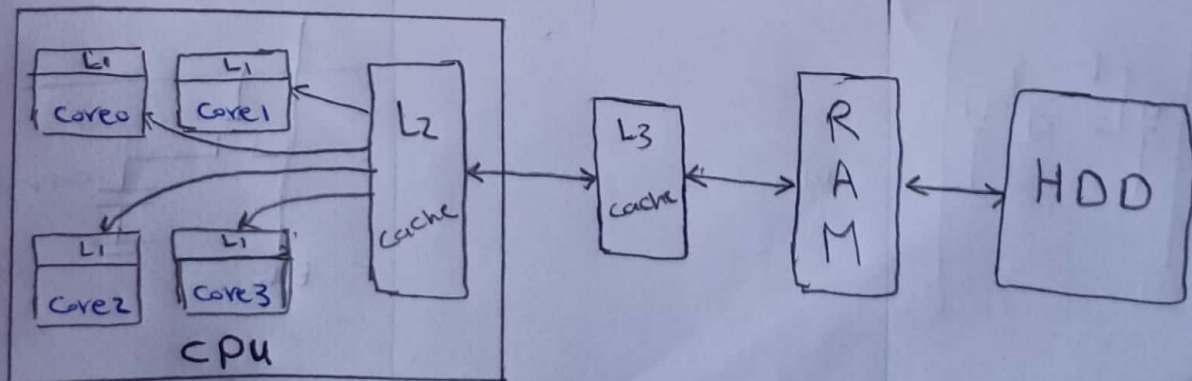
- in the core
- in the CPU
- smallest cache
- called \leftarrow cache
 - level one \leftarrow Primary
 - internal
- Fastest cache

L2 cache

- not in the core
- but in the CPU
- larger than L1
smaller than L3
- called \leftarrow cache
 - level two \leftarrow Secondary
 - external
- slower than L1
faster than L3

L3 cache

- not in the CPU
- but in the mother board
- Largest cache
- called \leftarrow cache
 - level three \leftarrow external
- slowest cache.



Type	Volatile	Writable	Erase Size	max erase cycles	Cost Per byte	Speed
SRAM	✓	✓	Byte	unlimited	expensive	Fast
DRAM	✓	✓	Byte	unlimited	moderate	moderate
PRoM	X	✓ one Time only	We Cannot erase data	We cannot erase data	moderate	Fast
Masked RoM	X	X	We cannot erase data	We cannot erase data	Cheaper	Fast
EPRoM	X	✓ with burner	all the data	limited (see the datasheet)	moderate	Fast
EEPROM	X	✓	Byte	limited (see the datasheet)	expensive	Fast to read slow to erase slow to write
Flash	X	✓	by the block	limited (see the datasheet)	moderate	Fast to read slow to erase slow to write
NVRAM	X	✓	Byte	unlimited	expensive	Fast

