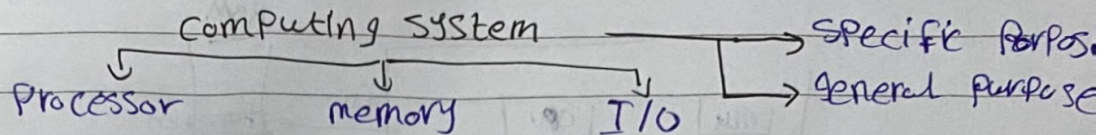
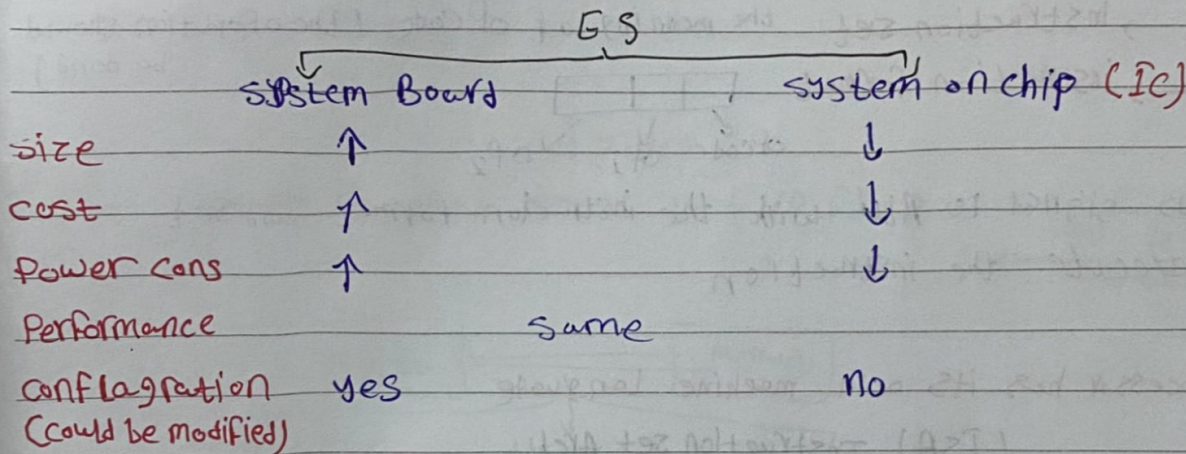
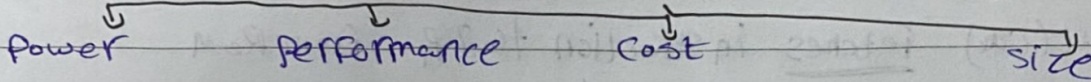


Lec 1



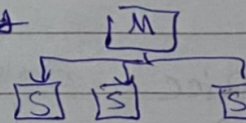
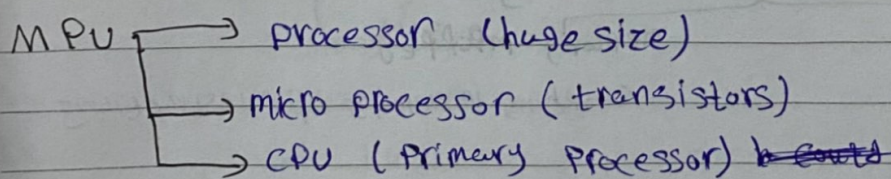
Embedded system is a specific purpose computing system.

Embedded system challenges



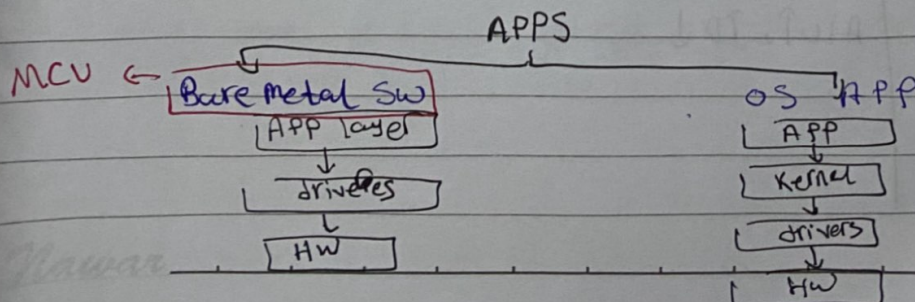
IC: It's a single chip has a specific purpose

EX: RAM, ROM, micro Processor, timer 555



MCU: Small computer on chip.

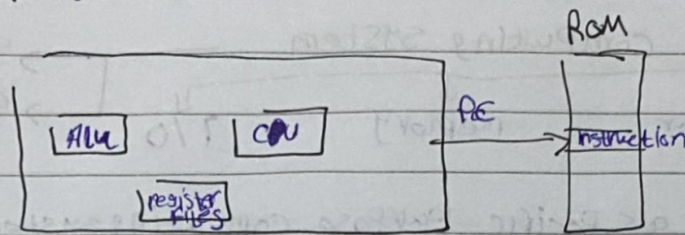
* MPU is a part of MCU



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1] Processor : its job is Instruction life cycle (Fetch - decode - execute)

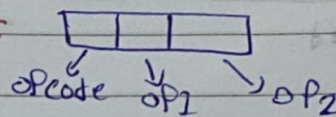


Instruction life cycle:

1] Control Unit (CU) fetches instruction to IR from Ram

2] Instruction decode (ID) decodes the instruction in IR

decode → instruction set the meaning of opCode (the operation should be done)
 → instruction format

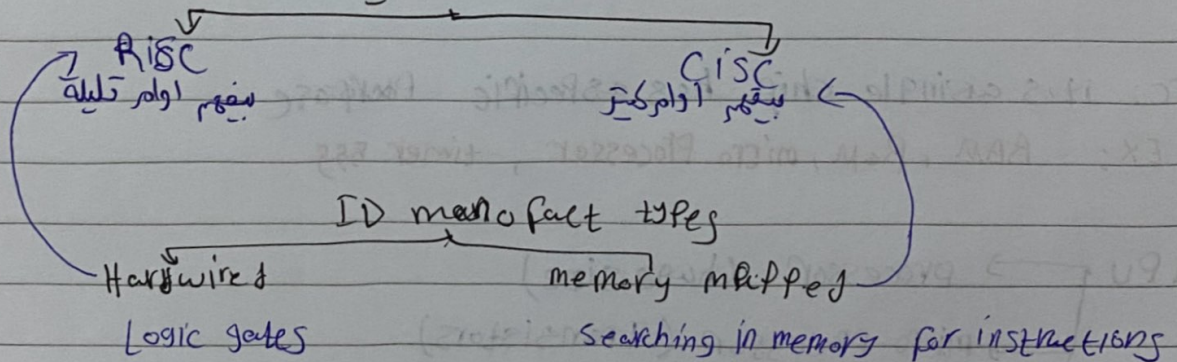


3] CU sends signal to ALU with the instruction format and set

4] ALU execute the instruction

* each processor has its own machine language

(ISA) Instruction set Arch



	RISC	CISC
size	AW ↓, ID ↑	AW ↑, ID ↓
cost	↑ SW, ↓ HW	↓ SW, ↑ HW
Power con		
Performance	AW ↓, ID ↑	AW ↑, ID ↓

2] Register files

- general Purpose (temp data storage)
- special Purpose

special Purpose registers:

1) PC: next instruction

2) Stack Pointer (SP): آدرس نگه داری

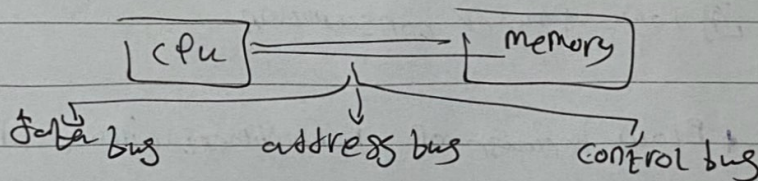
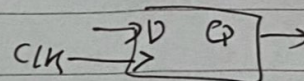
3) ACC: store ALU results temp

4) IR: store fetched instruction

5) PSW (Process Status Word): group of flags each one has a specific purpose

Memory

Basic memory element is D Flip Flop



read: Address line → bit address

Control line → read

data → data bus → CPU

write: Address line → address

Control → read/write

data line → data → memory address

memory types

volatile

RAM

آرامش

non volatile

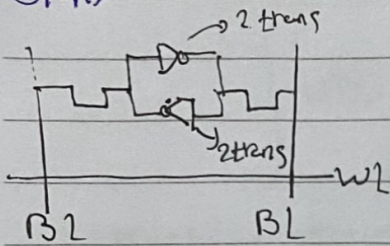
ROM

آرامش

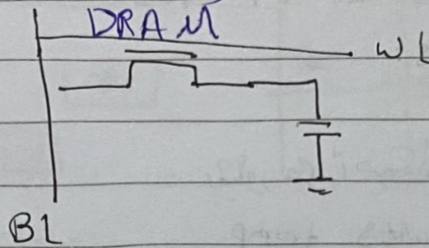
Hybrid

☐ Volatile : RAM

SRAM



DRAM



Based on transistor

bit → FLIPFLOP (6 Trans)

Based on capacitor

bit → capacitor

it needs refreshment circuit

→ if charged = 0

→ charged = 1

Advn:

☐ faster than DRAM

☐ simple HW

☐ low cost

☐ high density

☐ low power consumption

Disadv:

- High cost.

→ Slow because of refreshment circuit priority higher than CPU.

SRAM

DRAM

Size

↓

↑

Cost

↑

↓

Power con

↓

↑ (refreshment circuit)

Performance
(μs)

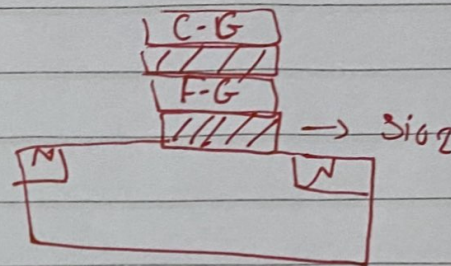
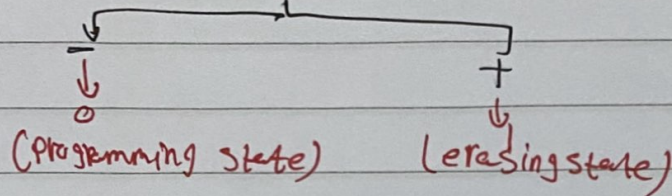
↑

↓

2] Non-Volatile (ROM)

based on floating gate mosfet

قائمة (FG)



ROM types

Mask programmable ROM

PROM

Eraser EPROM

- No chance to edit code

- user put the code

- could be erased by (UV)

- one time program

- one time program

- live for 10 years

لا يمكن تغيير

costs = Noise sensitive

3] Hybrid

RAM → read and write

ROM → non volatile

Hybrid types

E² PROM

Flash

NVRAM

electrical

- could be erased with electric - Electrical erasable

1) SRAM + Battery

- Endurance

Endurance

2) SRAM + EEPROM + Battery

100K times

10K times

لا يستطيع الذاكرة الاحتفاظ بالبيانات

- Byte access

- Block access

لذلك EEPROM → SRAM

- High cost per bit (cons)

- Low cost per bit

دائم

Internal EPROM

External

used more