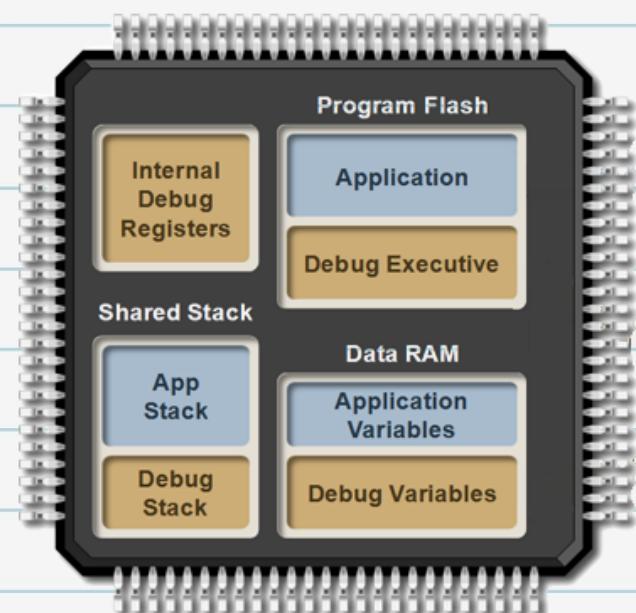
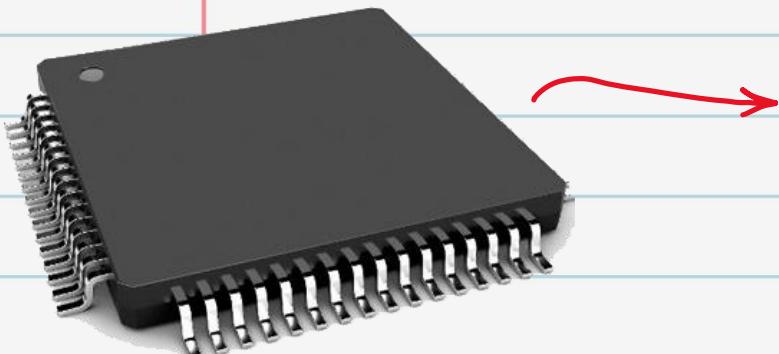
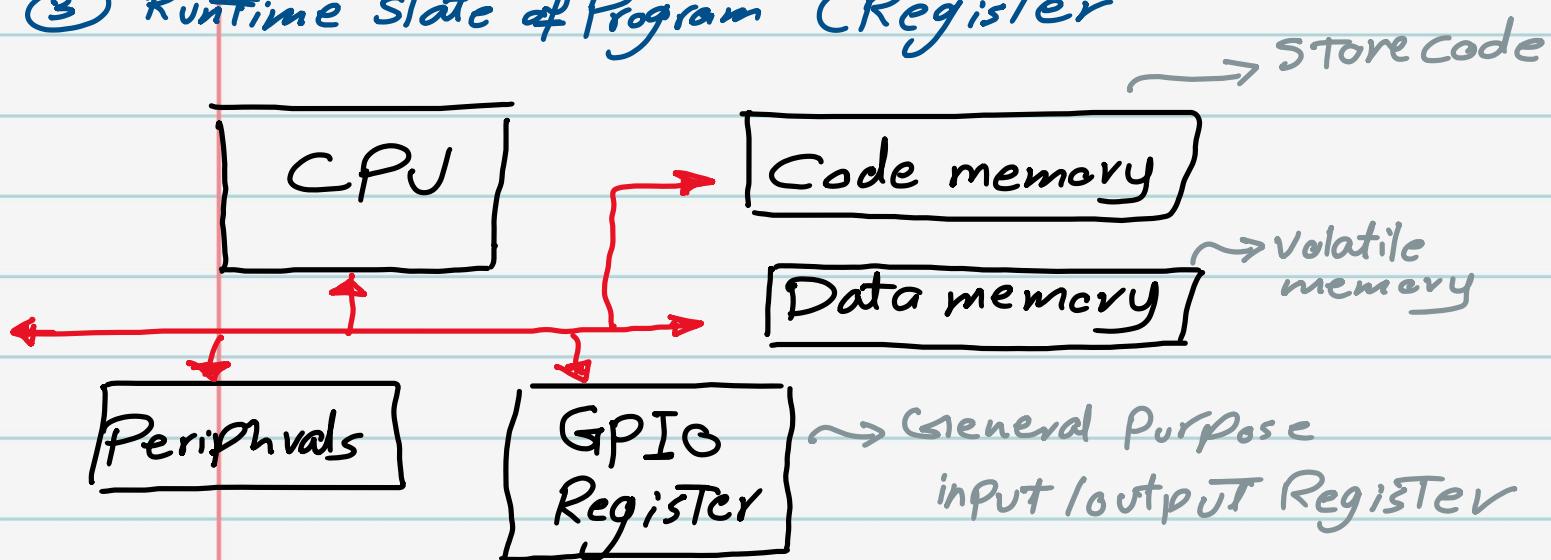


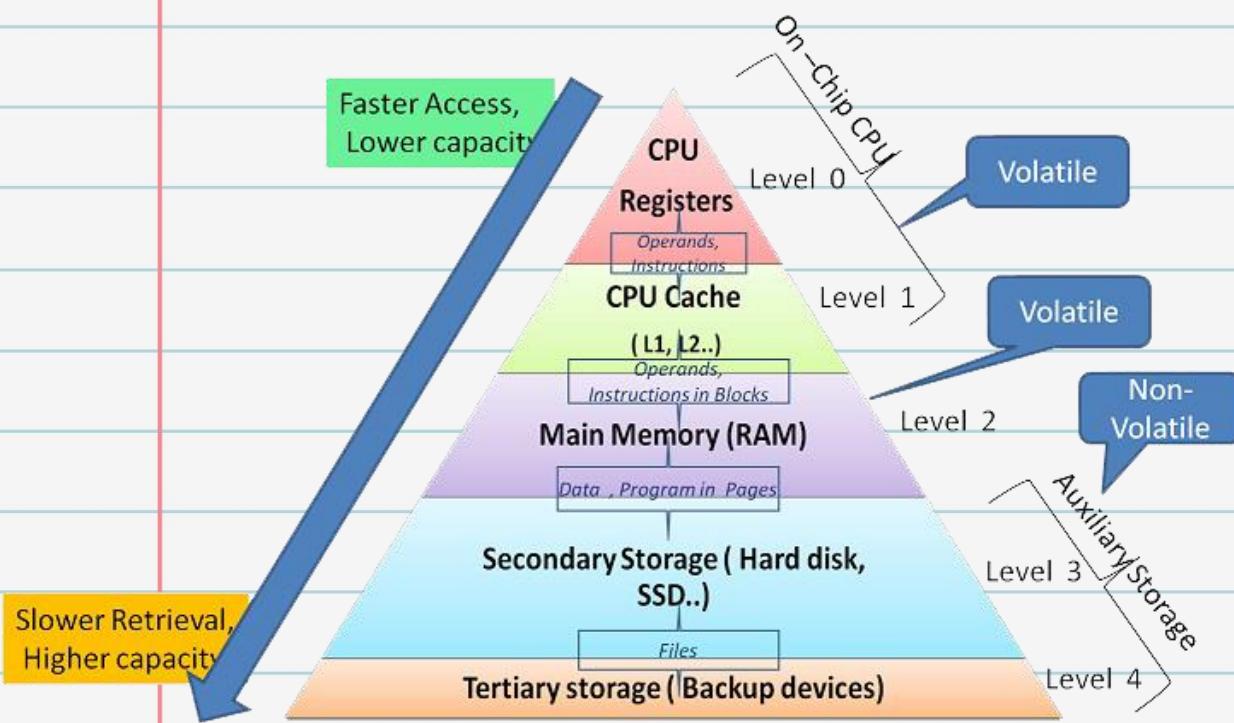
"memory" << organization>>

- every bit has specific memory location
 - Bit : The smallest storage unit can store 0 and 1
 - memory in Embedded system measure by kilo or mega byte
- we need three types of storage for a program
- ① Code memory
 - ② Data memory
 - ③ Runtime state of Program (Register)



memory characteristics :-

- Capacity (Size of memory)
- Volatility
- Access
- Power Consumption
- Latency (Time of read and write)
- Durability (number of write and read operations)
- Transaction size (amount of data we can transfer)



Note

Embedded System don't need big memory

∴ ↑ Capacity ≠ ↑ Performance

as Capacity increase as Complexity increase

so we need to limit size, power and cost of system

memory

Volatile memory

→ SRAM "Static Random Access memory"

- Faster than DRAM (x4)
- To store 1bit we need more than one Transistor
so it will be more expensive

→ DRAM "Dynamic Random Access memory"

- need to refreshed every few milliseconds
- it more cheaper than SRAM

note

Now days in Embedded system it can be used SRAM and DRAM together as when SRAM is full it will store in DRAM

non Volatile memory

→ masked ROM

- Data is impossible changed any time
- its area is smaller
- IC area bit for masked Rom lower compared by another Types

→ PROM (Programmable Read only memory)

- They are Programmable chip that Programme of one Time only
- it can't be erased or reprogrammed
- it OTP (only Time Programmed)

→ EEPROM (Erasable Programming Read only memory)

- They Can Programming Several Times
- Used in development Phase of the Software as erasing/re programming
- it can be changed to PROM when developers finish their development Process

→ EEPROM (Electrically Erasable Programming ROM)

- Can be erased and reprogrammed using electricity
- they can be used in:
 - ① Storing firmware
 - ② Storing runtime
 - ③ Storing updated firmware
- can read and write one byte

→ Flash

- it is the most popular
- it has all qualities of (EEPROM) except one; that EEPROM program one bit at time while flash can reprogram one block (number of bits) at time
- it more cheaper than EEPROM

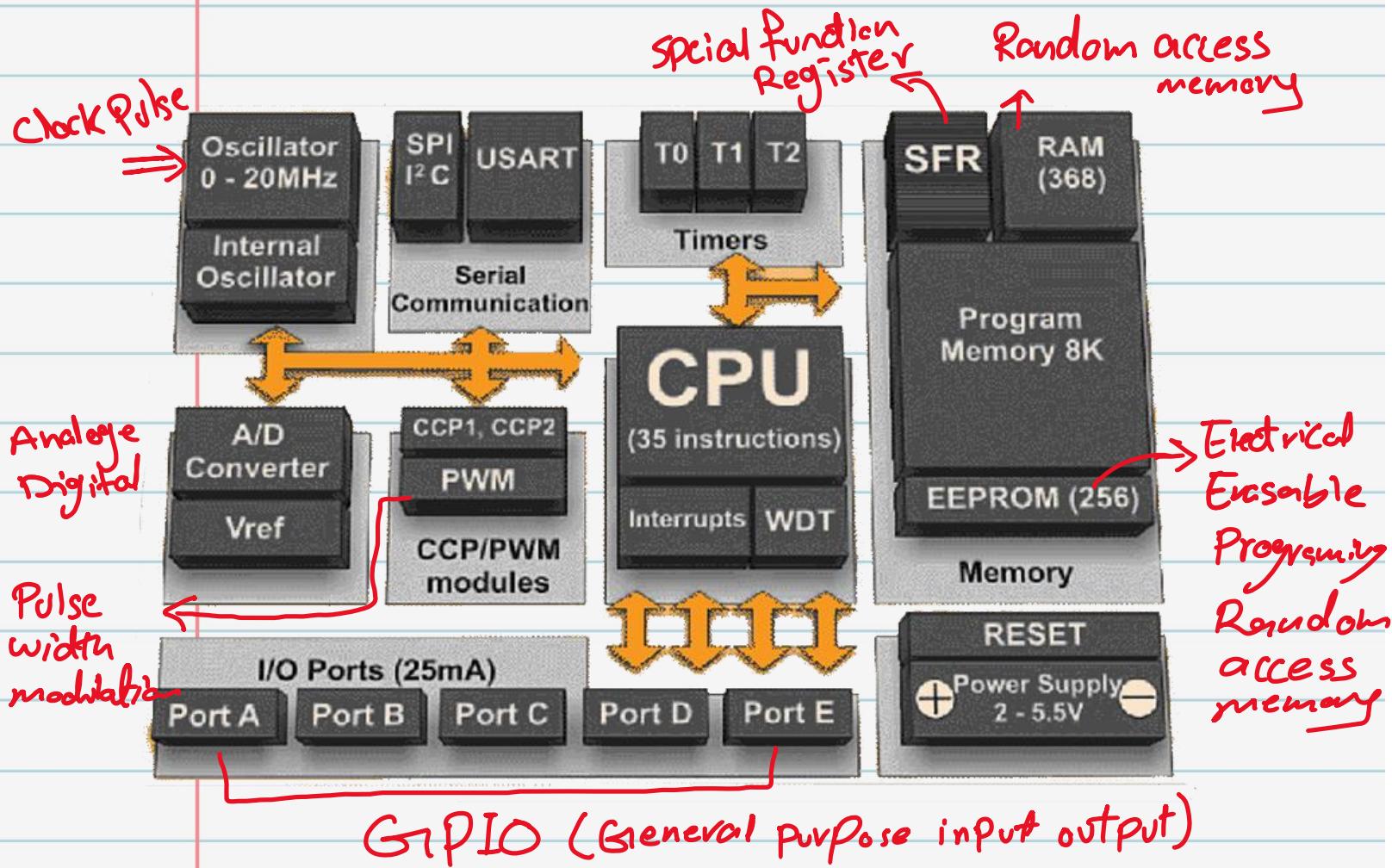
→ NVRAM (non Volatile RAM)

- it has own Power Supply
- fast as RAM
- it can store in memory although power is cut off

Note

• sector = 1 page
1 page = bytes

micro controller internal Block



- **RAM :** Save Volatiled Variable
- **Program memory :** Save code
- **EEPROM :** Save important modules
- **A/D converter:** Convert signals from Analogue to digital
- **interrupts:** receive message from peripherals to send it to CPU
- **PWM :** Control on the voltage will enter to GPIOs