Embedded System Concepts 1

Computing System components:

1. Processor
2. Memory
3. I/O peripherals

An Embedded System: is a computing system but with limited resources to perform specific tasks

Two ways to implement E.S:

1. **System on board (SOB)** 3 ic each is a component then built on a board
2. **System on chip (SOC)** one ic with all components

ES Challenges:

1. Performance
2. Size
3. Cost
4. Power consumption

	SOB	SOC
Performance	-	-
Cost	expensive	Cheaper
Size	Larger	Smaller
Power Consumption	More	Less
Configurability	Higher	Lower

Every Embedded System has 2 stages that must occur:

1. R&D (Development- SOB)
2. Production (Soc)

Microcontroller: Complete System on Chip

Microprocessor: 1 element of the 3 elements of the computing system

1. **Processor (Components)**
   1. 3 Busses: Address / Data / Control

2. CU: Control Unit contains ID
3. ALU
4. Register File

Process
1. **Control unit:** Fetches the instruction from the memory
2. **Instruction Decoder (id):** decoding the instruction
   Instruction format:

1 byte		
opcode	Op1	Op2
3bits	3bits	3bit

The opening code defines what logic circuit will be used

3. **ALU (Arithmetic logic unit):** Executes

ISA (Instruction Set Architecture)

RISC: Reduced instruction set computing (Less Instruction)

CISC: Complex instruction set computing (More Instruction)

|	RISC	CISC
Performance	**Fairly the same**	
Cycles to execute code	Less	More
Cost (Hardware)	Cheaper	Expensive
Cost (Software)	Expensive	Cheaper
Size (ALU)	Smaller	Bigger
ID	Hardwired (bugger size)	Microprogrammed (size smaller)
Power consumption	**Fairly the same**	

4. **ID (2 ways):**
   1. **Hardwired ID (Through gates)**
   2. **Microprogrammed:** Memory with software
      Slowest Hardware is faster than the fastest software

Register File:

1. **PC:** Program counter (Address of the next instruction to be executed)
2. **IR:** Instruction Register (Instruction to be executed)
3. **ACC:** Accumulator register (the result / output of ALU)
4. **GPR:** General purpose registers
5. **PSW:** Processor status word (Keeps track of Flag Registers)
6. **SP:** Stack pointer (points to data storage address)
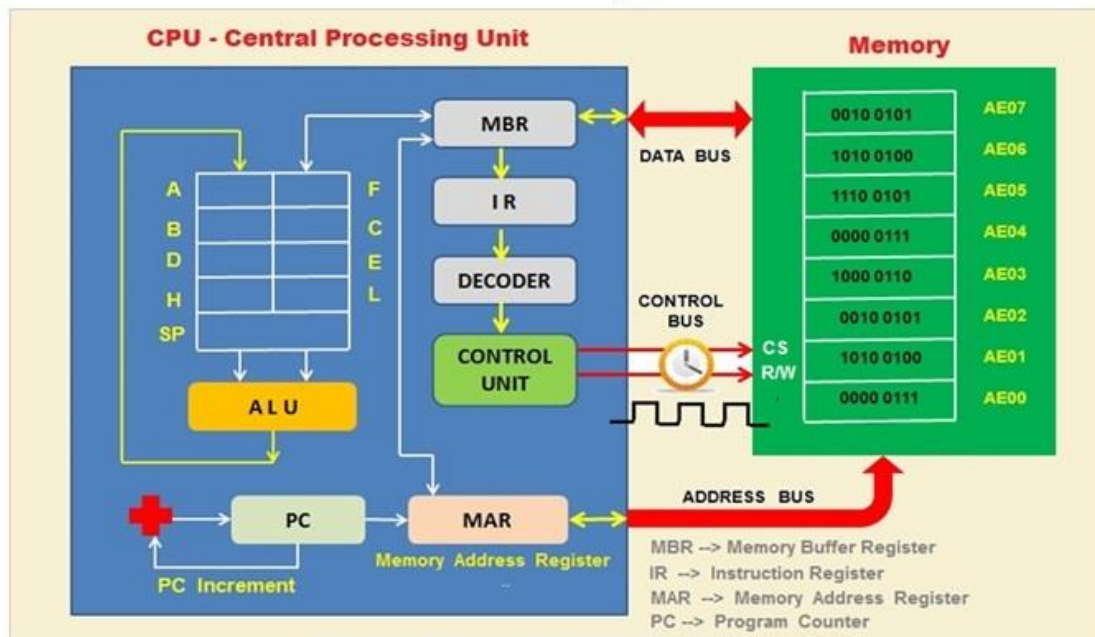
Memory:

1. **Non-Volatile:** Data is permanent
2. **Volatile:** RAM (2 Types) Data is temporary

	DRAM (Capacitors) Dynamic	SRAM (Transistors) Static
Performance	Slower	Faster
Cost	Cheaper	Expensive
Size	Bigger	Smaller
Power Consumption	Greatly Higher (Has Refreshing circuit)	Lower