MICROPROGRAMMED CONTROL UNIT

WILKES' DESIGN FOR A MICROPROGRAMMED CONTROL UNIT

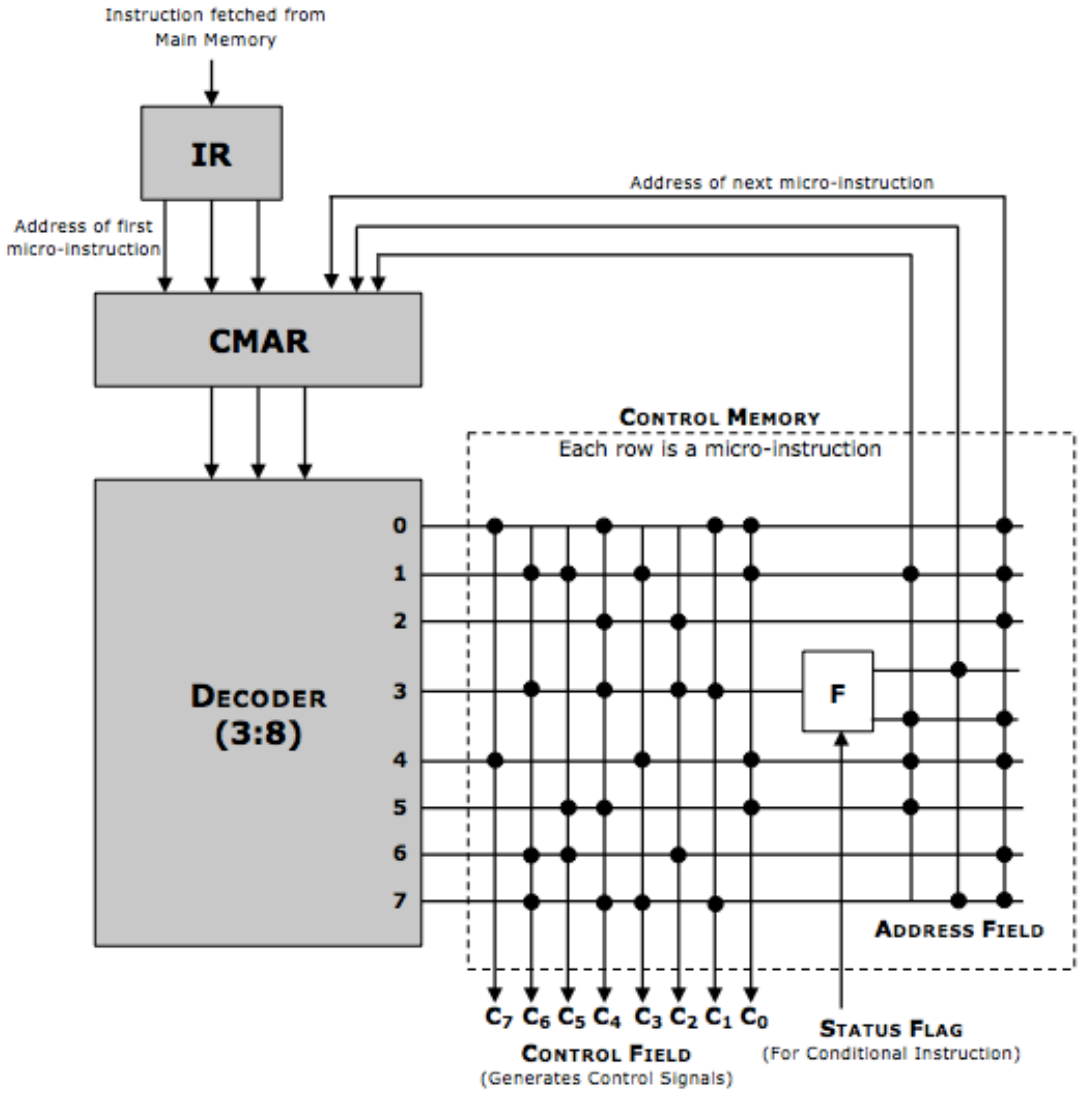
1) Microprogrammed Control Unit produces control signals by **software**, using **micro-instructions**
2) A program is a set of instructions.
3) An instruction requires a set of Micro-Operations.
4) **Micro-Operations are performed by control signals**.
5) Instead of generating these control signals by hardware, **we use micro-instructions**.
6) This means **every instruction requires a set of micro-instructions**
7) **This is called its micro-program**.
8) Microprograms for all instructions are **stored in a small memory called "Control Memory"**.
9) The Control memory is **present inside the processor**.
10) Consider an **Instruction** that is **fetched from the main memory** into the Instruction Register (**IR**).
11) The processor uses its unique **"opcode"** to identify the **address of the first micro-instruction**.
12) That address is loaded into **CMAR** (Control Memory Address Register).
13) CMAR passes the address to the **decoder**.
14) The decoder **identifies the corresponding micro-instruction** from the Control Memory.
15) A micro-instruction has **two fields**: a control filed and an address field.
16) **Control field:** Indicates the **control signals to be generated**.
17) **Address field:** Indicates the **address of the next micro-instruction**.
18) This address is further **loaded into CMAR** to **fetch the next** micro-instruction.
19) For a **conditional micro-instruction**, there are **two address fields**.
20) This is because, the address of the next micro-instruction **depends on the condition**.
21) The condition (true or false) is **decided by the appropriate control flag**.
22) The control memory is usually implemented using FLASH ROM as it is writable yet non volatile.

ADVANTAGES

1) The biggest advantage is **flexibility.**
2) Any **change** in the control unit can be performed by **simply changing the micro-instruction**.
3) This makes **modifications and up gradation** of the Control Unit **very easy**.
4) Moreover, software can be **much easily debugged** as compared to a large Hardwired Control Unit.

DRAWBACKS

1) **Control memory** has to be present **inside** the processor, **increasing its size.**
2) This also **increases the cost** of the processor.
3) The **address field** in every micro-instruction **adds more space** to the control memory. This can be easily **avoided** by proper **micro-instruction sequencing**.


Instruction fetched from Main Memory
IR
Address of next micro-instruction
Address of first micro-instruction
CMAR
CONTROL MEMORY
Each row is a micro-instruction
DECODER (3:8)
0
1
2
3
4
5
6
7
F
ADDRESS FIELD
C7 C6 C5 C4 C3 C2 C1 C0
CONTROL FIELD
(Generates Control Signals)
STATUS FLAG
(For Conditional Instruction)