Computer System Architecture
COMP201Th
Unit: 2
Basic Computer Organization and Design

Lecture: 8

Microprogrammed Control

In any digital computer, the function of the control unit is to initiate sequences of microoperations. The number of different types of microoperations that are available in a given system is finite.

Generally, control unit of a digital computer may be designed using one of the following techniques:

- **Hardwired Control Unit:** In this type, the control signals are generated by hardware using conventional logic design techniques.
- **Microprogrammed Control Unit:** In this type, the control variables stored in memory at any given time can be represented by a string of 1's and 0's called a control word. As such, control words can be programmed to perform various operations on the components of the system.

  Each word in control memory contains within it a microinstruction. Generally, a microinstruction specifies one or more microoperations. A sequence of microinstructions forms what is called a microprogram.

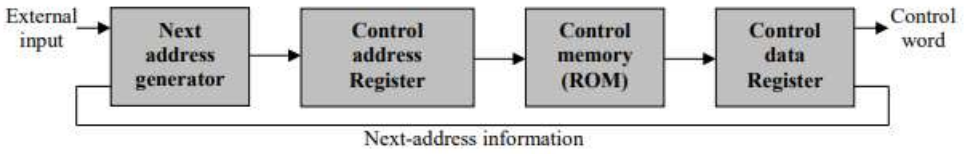
Generally, a computer that employs a microprogrammed control unit will have two separate memories:

1. **The Main Memory:** This memory is available to the user for storing programs. The user's program in main memory consists of machine instructions and data.
2. **The Control Memory:** This memory contains a fixed microprogram that cannot alter by the occasional user. The microprogram consists of microinstructions that specify various internal control signals for execution of register microoperations.

Each instruction initiates a series of microinstructions in control memory. These microinstructions generate the microoperations to:

- Fetch the instruction from main memory.
- Evaluate the effective address.
- Execute the operation specified by the instruction.
- Finally, return the control to the fetch phase in order to repeat the cycle for the next instruction.

Fig. below shows the general block diagram of a microprogrammed control unit:



The function of the control address register is to specify the address of the microinstruction, while the function of control data register is to hold the microinstruction read from memory.

Advantages of Microprogrammed Control Unit:

Since the microprograms can be changed relatively easily, therefore, microprogrammed control units are very flexible in comparison to hardware control units.

Disadvantages:

- Hardware cost is more because of the control memory and its access circuitry.
- This is slower than hardwired control unit because the microinstruction are to be fetched from the control memory which is time consuming.

Subroutines:

Subroutines are programs that are used by other routine to accomplish a particular task. An example of these subroutines is the subroutine needed to generate the effective address of the operand for an instruction.

A subroutine can be called from any point within the main body of the microprogram.