Chapter 7

Input / Output Organization

peripheral devices

- An external device connected to an I/O module also called Interface is often referred to as a peripheral device or simply a peripheral.
- Among the most known peripherals some of them are, keyboard, display unit and printers.
- Video monitors are most commonly used peripheral.

cont…

- The input and output organization of a computer is a function of a size of computer and devices connected to it.
- The difference between a small and large system is mostly depends on the amount of hardware the computer has available for communicating with peripheral unit and the number of peripheral connected to the system.

cont….

- The input/output subsystem of a computer, referred to as I/O, provides an efficient mode of communication between the central system and the outside environment(transferring and processing)

cont…

- I/O operations are accomplished through a wide assortment of external devices that provide a means of exchanging data between the external environment and the computer.
- An external device attaches to the computer by a link to an I/O module.

input output interfaces

- Input output Interfaces provides method for transferring information between internal storage and external IO devices
- Peripheral connected to the computer needs special communication link for interacting them with the central processing unit.

connection of I/O module to peripheral devices

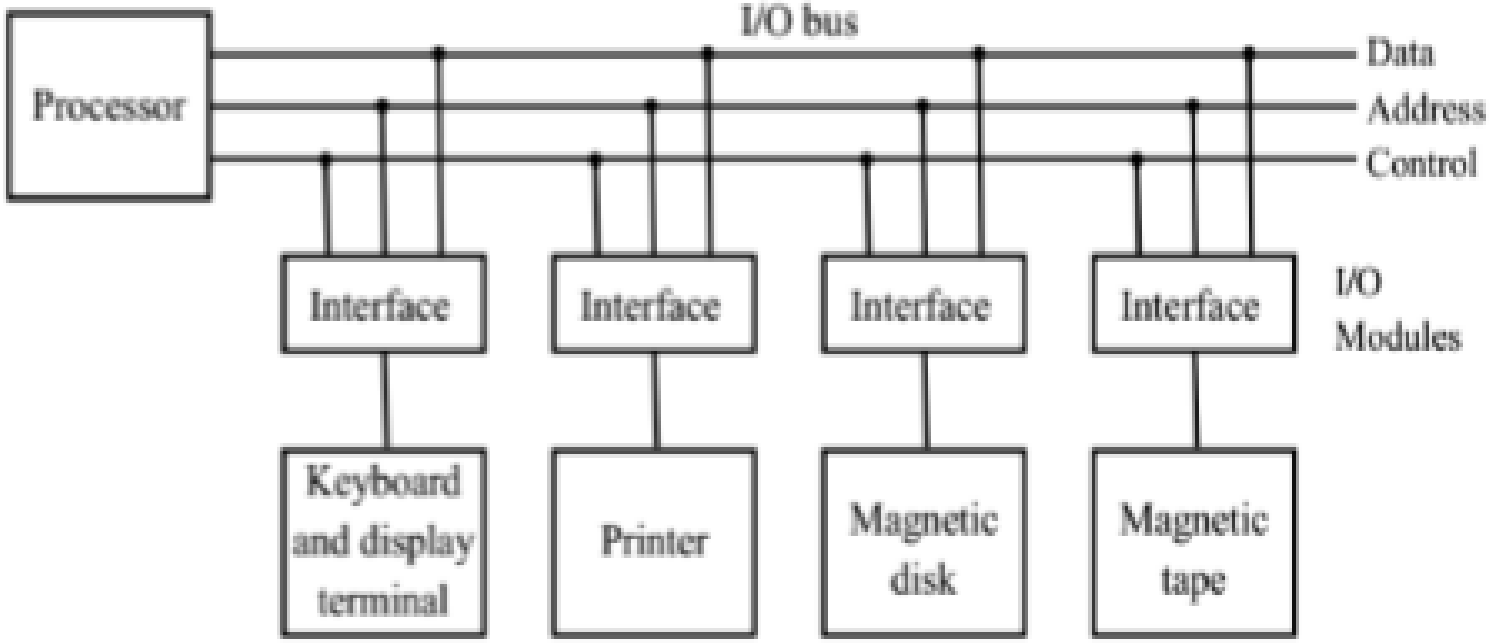

Figure 7-1: Connection of CPU, I/O module and peripheral devices

classification of external devices

External devices broadly can be classified into three categories:

- Human readable
- Machine readable
- Communication

asynchronous data transfer

- The internal operation in digital system is synchronized by means of clock pulse supplied by a common pulse generator.

input/output module

- It is the entity within a computer that is responsible for the control of one or more external devices and for the exchange of data between those devices and main memory and/or CPU.

I/O Module Function

- The major functions or requirements for an I/O module are:

cont…

- Control & Timing
- CPU Communication
- Device Communication
- Data Buffering
- Error Detection

cont…

- I/O module must have the capability to engage in communication with the CPU and external device. Thus CPU communication involves
- ✓ Command decoding:
- ✓ Data:
- ✓ Status reporting

address recognition

- The I/O module must also be able to perform device communication. This communication involves
  - ✓ commands,
  - ✓ status information, and
  - ✓ data.
- Some of the essentials tasks are listed below:
  - ✓ Error detection:
  - ✓ Data buffering:

I/ O techniques (data transfer mode)

- Three techniques are possible for I/O operations or data transfer mode. They are:

✓ Programmed I/O

✓ Interrupt driven

✓ Direct Memory Access (DMA)

programmed i/o

- With Programmed I/O, data are exchanged between the CPU and the I/O module.
- The CPU executes a program that gives it direct control of the I/O operation
- If the CPU is faster than I/O module, there is wastage of CPU time.

Cont….

- The sequences of actions that take place with programmed I/O are:
- ✓ CPU requests I/O operation
- ✓ I/O module performs operation
- ✓ I/O module sets status bits

Cont…..

- CPU checks status bits periodically
- I/O module does not inform CPU directly
- I/O module does not interrupt CPU

I/O command

- Four types of I/O commands can be received by the I/O module when it is addressed by the CPU. They are

1.A control command

2. A test command

3. A read command

4. A write command

I/O Mapping

- When the CPU, main memory, and I/O module share a common bus two modes of addressing are possible.

memory mapped I/O

- Devices and memory share an address space
- I/O looks just like memory read/write
- No special commands for I/O
- Large selection of memory access commands available

isolated I/O

- Separate address spaces
- Need I/O or memory select lines
- Special commands for I/O and Limited set

priority interrupt

- A priority interrupt is a system that establish a priority over various sources to determine which condition is to be serviced first when two or more requests arrives simultaneously.

interrupt driven i/o.

- With Interrupt driven I/O, the CPU issues a command to I/O module and it does not wait until I/O operation is complete but instead continues to execute other instructions.
- When I/O module has completed its work it interrupts the CPU.
- Using Interrupt Driven I/O technique CPU issues read command.

cont….

- An interrupt is an exception condition in a computer system caused by an event external to the CPU
- interrupts enable transfer of control from one program to another to be initiated by an event that is external to a computer.
- Execution of the interrupted program resumes after completion of execution of the interrupt service routine.

direct memory access (DMA)

- Direct Memory Access is capabilities provided by some computer bus architectures that allow data to be sent directly from an attached device (such as a disk drive) to the memory on the computer's motherboard.
- The microprocessor (CPU) is freed from involvement with the data transfer, thus speeding up overall computer operation.

cont….

- When the CPU wishes to read or write a block of data, it issues a command to the DMA module and gives following information:
- CPU tells DMA controller:

✓ Whether to read or write

✓ Device address

✓ Starting address of memory block for data

cont….

- Amount of data to be transferred
- Thus DMA controller steals the CPU‟s work of I/O operation.
- The DMA module transfers the entire block of data
- One word at a time, directly to or from memory, without going through CPU.

DMA configurations

- Some of the common configurations of DMA are:
  1. Single Bus Detached DMA
  2. Single Bus, integrated DMA
  3. DMA using an I/O bus

advantages of dma

- DMA is fast
- DMA is usually required to achieve maximum data transfer speed, and high speed data acquisition devices
- DMA also minimizes latency in servicing a data acquisition device
- DMA also off-loads the processor
- increasing overall system utilization.

serial communication

- A data communication processor is an I/O processor that distribute and collect data from many remote terminals connected through telephone and other communication lines
- it is a specialized I/O processor designed to communicate directly with data communication network.

cont….

- Data can be transmitted between two points in three different modes:

- ✓ simplex,
- ✓ half duplex
- ✓ full duplex.