Unit V: I/O Organization

Input/Output Systems:

- The Peripheral device is that which provide input and output for the computer, it is also called Input-Output devices.
- For Example: A keyboard and mouse provide Input to the computer are called input devices while a monitor and printer that provide output to the computer are called output devices.
- Just like the external hard-drives, there is also availability of some peripheral devices which are able to provide both input and output.

Communication Links:

- In micro-computer base system, the only purpose of peripheral devices is just to provide **special communication links** for the interfacing them with the CPU.
- To resolve the differences between peripheral devices and CPU, there is a special need for communication links.

The major differences are as follows:

1. The nature of peripheral devices is electromagnetic and electro-mechanical. The nature of the CPU is electronic. There is a lot of difference in the mode of operation of both peripheral devices and CPU.
2. There is also a synchronization mechanism because the data transfer rate of peripheral devices are slow than CPU.
3. In peripheral devices, data code and formats are differ from the format in the CPU and memory.
4. The operating mode of peripheral devices are different and each may be controlled so as not to disturb the operation of other peripheral devices connected to CPU.

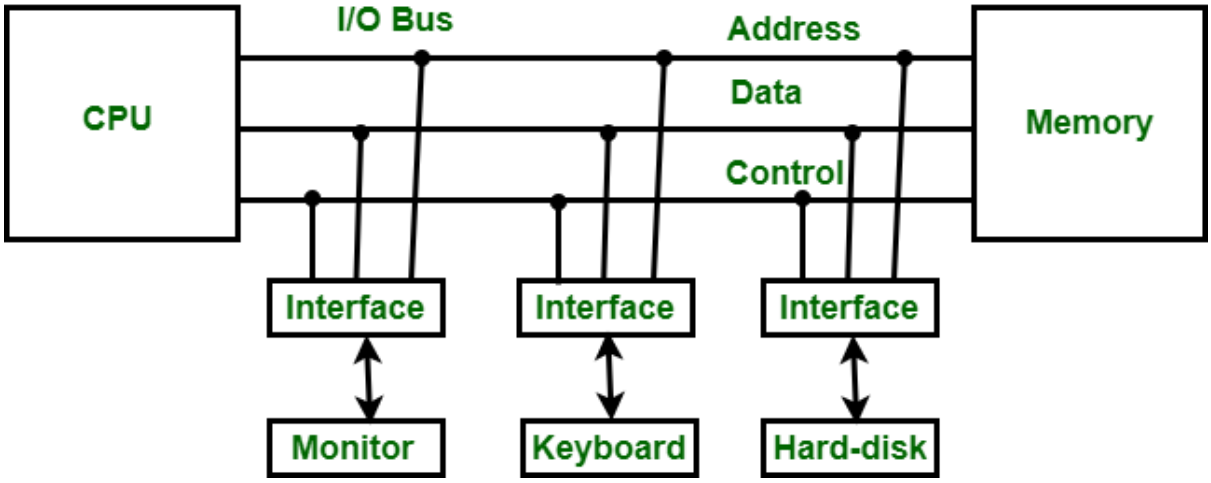
There is a special need of the **additional hardware** to resolve the differences between CPU and peripheral devices to supervise and synchronize all input and output devices.

Input-Output Interface:

Input-Output Interface is used as an method which helps in transferring of information between the internal storage devices i.e. memory and the external peripheral device

Functions of Input-Output Interface:

1. It is used to synchronize the operating speed of CPU with respect to input-output devices.
2. It selects the input-output device which is appropriate for the interpretation of the input-output device.
3. It is capable of providing signals like control and timing signals.
4. In this data buffering can be possible through data bus.
5. There are various error detectors.
6. It converts serial data into parallel data and vice-versa.
7. It also convert digital data into analog signal and vice-versa.



Input/Output Data Transfer Techniques OR

Modes of I/O Data Transfer

Data transfer between the central unit and I/O devices can be handled in generally three types of modes which are given below:

1. **Program controlled I/O or Polling control .**
2. **Interrupt program controlled I/O or interrupt driven I/O.**
3. **DMA Controlled or Hardware controlled I/O.**

1. **Program controlled I/O or Polling control:**

- In program controlled I/O, the transfer of data is completely under the control of the microprocessor program.
- This means I/O instructions written in computer program initiated data transfer. Each data item transfer is initiated by the instruction in the program.
- Usually the program controls data transfer to and from CPU and peripheral. Transferring data under programmed I/O requires constant monitoring of the peripherals by the CPU.

- In most of the cases it is necessary to check whether the device is ready for data transfer or not.
- To check this, microprocessor polls the status bit associated with the I/O device.

2. **Interrupt program controlled I/O or interrupt driven I/O.**

- In interrupt program controlled approach, when a peripheral is ready to transfer data, it sends an interrupt signal to the microprocessor.
- This indicates that the Input Output Transfer Techniques is initiated by the external I/O device.
- When interrupted, the microprocessor stops the execution of the program and transfers the program control to an interrupt service routine.
- This interrupt service routine performs the data transfer. After the data transfer, it returns control to the main program at the point it was interrupted.

3. **DMA Controlled or Hardware controlled I/O**

- To increase the speed of data transfer between memory and I/O, the hardware controlled I/O is used.

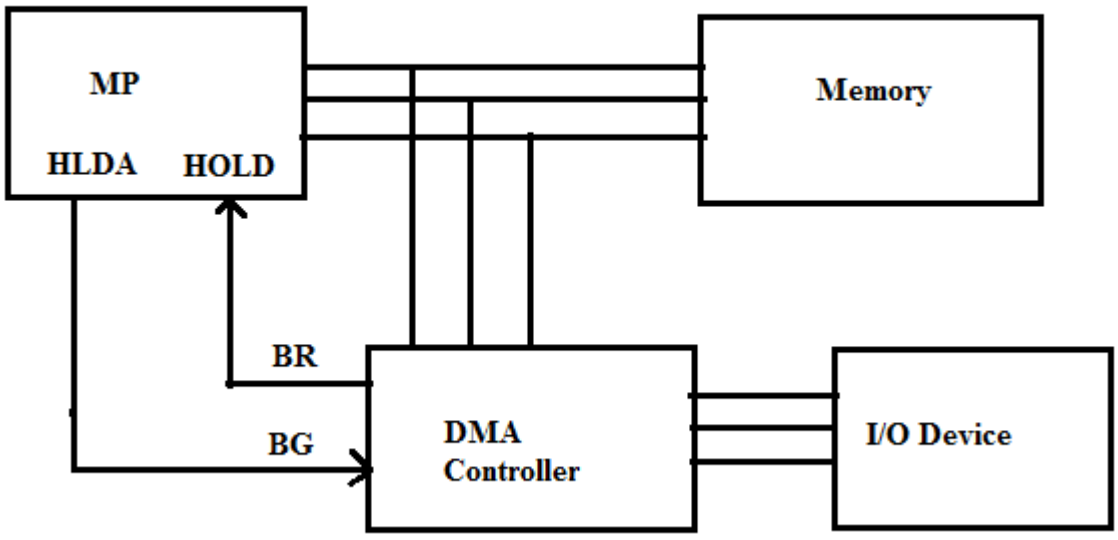
- It is commonly referred to as direct memory access (DMA). The hardware which controls this data transfer is commonly known as DMA controller.

- The DMA controller sends a HOLD signal, to the microprocessor to initiate data transfer. In response to HOLD signal microprocessor releases its data, address and control buses to the DMA controller.

- Then the data transfer is controlled at high speed by the DMA controller without the intervention of the microprocessor.

- After data transfer, DMA controller sends low on the HOLD pin, which gives the control of data, address, and control buses back to the microprocessor. This type of data transfer is used for large data transfers.

- Many hardware systems use DMA such as disk drive controllers, graphic cards, network cards and sound cards etc. It is also used for intra chip data transfer in multicore processors.
- In DMA, CPU would initiate the transfer, do other operations while the transfer is in progress and receive an interrupt from the DMA controller when the transfer has been completed.



Synchronous and Asynchronous Data Transfer

- In synchronous data transfer, the transmitter and the receiver are synchronized and uses a common timing signal. It uses timing signals for synchronization. Here, the data flows as a continuous stream one after the other.
- The transmitter sends data, and the receiver counts the number of bits in the received data.
- Furthermore, there are no gaps between data. In this method, the timing signals must be accurate to transfer data efficiently. Moreover, this method is faster than asynchronous data transferring.
- In asynchronous data transfer, the transmitter and the receiver do not use a common timing signal.
- Asynchronous Data Transfer is the data transfer method that sends data from transmitter to receiver with parity bits (start and stop bits) in uneven intervals.

Working Mechanism of Computer Peripheral

A **computer peripheral** is a device that is connected to a computer but is not part of the core computer architecture. The core elements of a computer are the central processing unit, power supply, motherboard and the computer case that contains those three components. Technically speaking, everything else is considered a peripheral device.

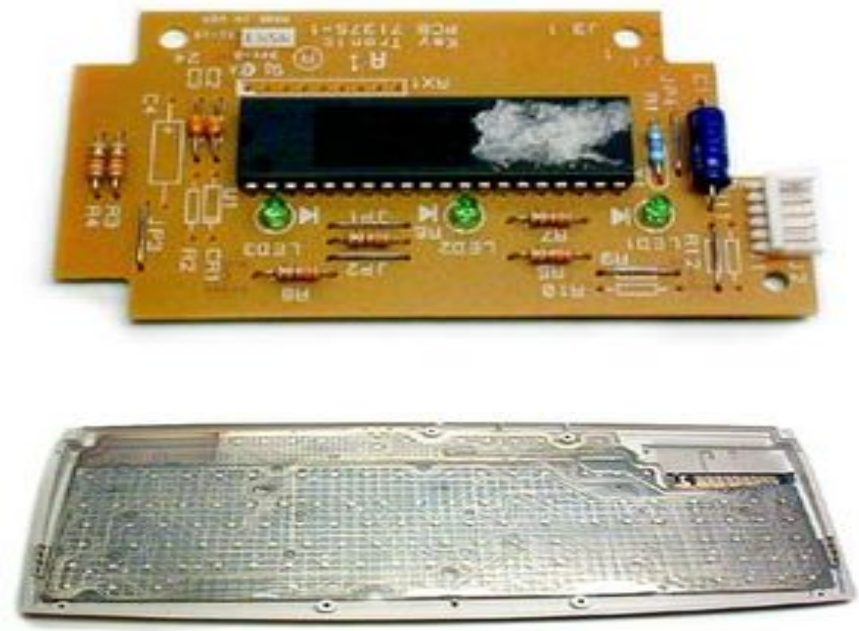
Types of Peripheral Devices

There are many different peripheral devices, but they fall into three general categories:

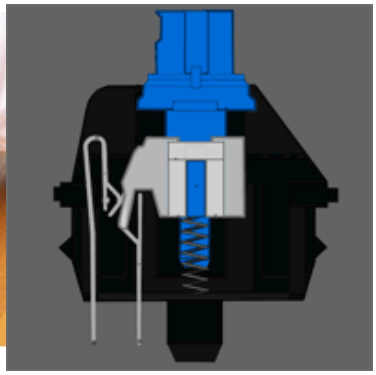
1. **Input devices**, such as a mouse and a keyboard
2. **Output devices**, such as a monitor and a printer
3. **Storage devices**, such as a hard drive or flash drive

1.Working Mechanism of Keyboard:

A keyboard is a lot like a miniature computer. It has its own processor and circuitry that carries information to and from that processor. A large part of this circuitry makes up the key matrix. The key matrix is a grid of circuits underneath the keys. The Microprocessor and controller circuitry of a keyboard is shown as below.



The key matrix is a grid of circuits underneath the keys. A keyboard contains many mechanical switches or push-buttons called "keys". When one of these are pushed, an electrical circuit is closed, and the keyboard sends a signal to the computer that tells it what letter, number or symbol it would like to be shown on the screen. If you press and hold a key, the processor recognizes it as the equivalent of pressing a key repeatedly.



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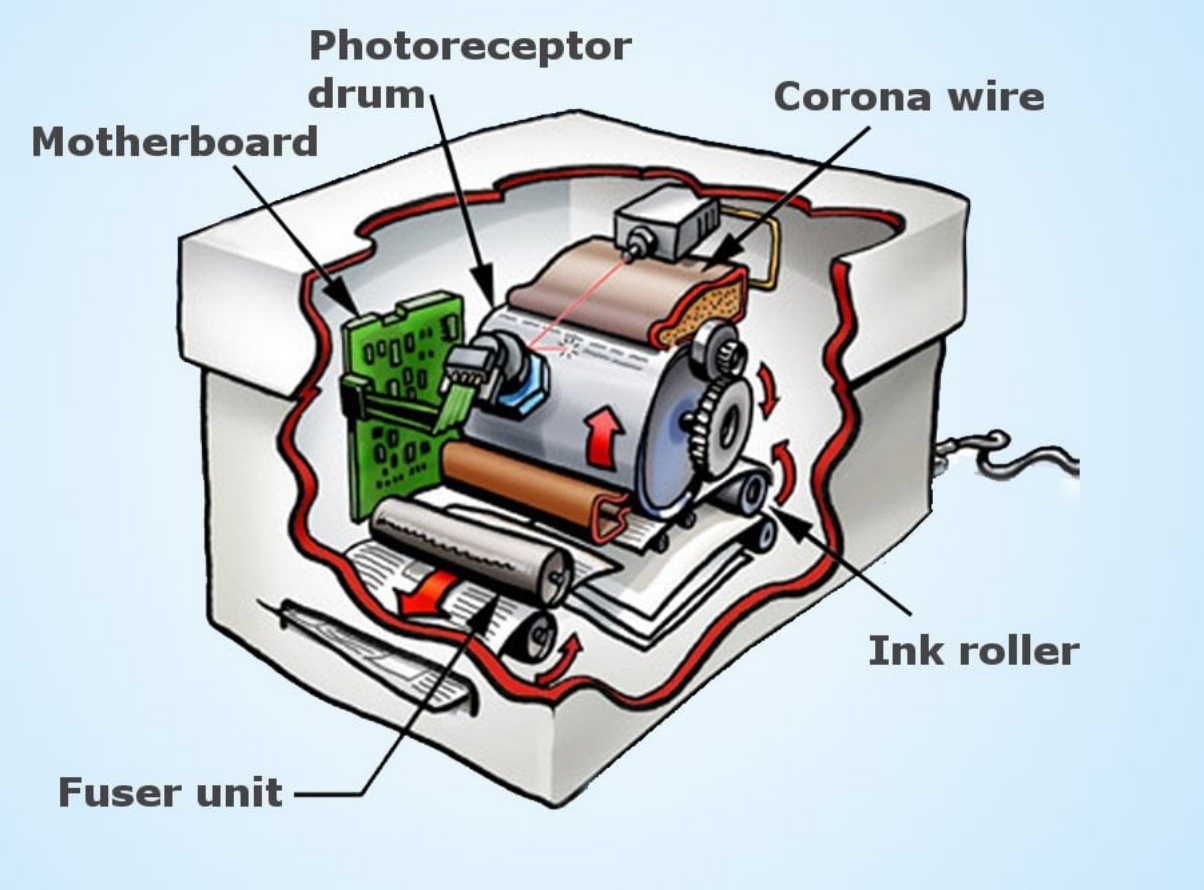
2. Working Mechanism of Printer

2.1 Working of Laser Printer:



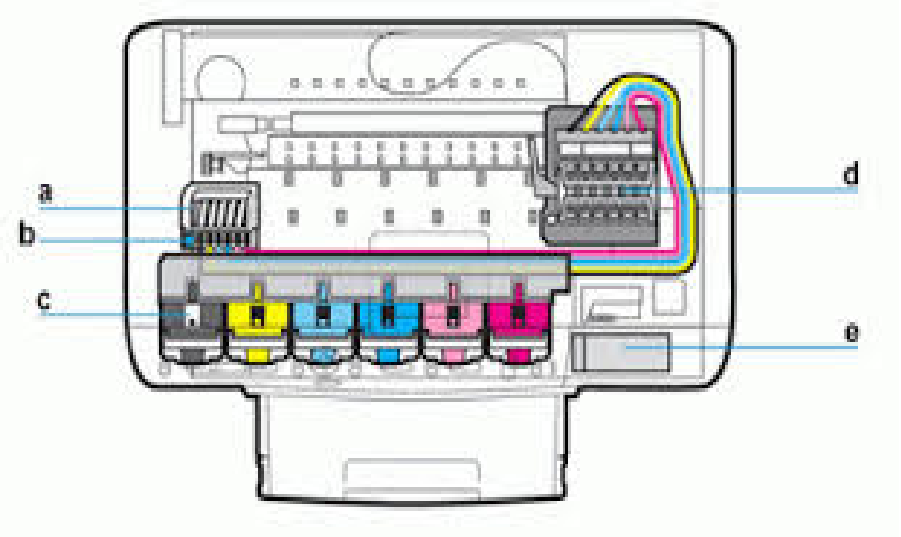
When the paper moves near the photoreceptor drum, it attracts the toner, which has a negative charge. The toner is attracted to it and sticks to the paper. Even then, the ink is not firmly placed on the paper. The paper finally passes through two hot rollers, known as the fuser unit. The heat and pressure from the rollers fuse the toner particles permanently into the fiber of the paper. *That* is how a printer prints a piece of paper.

2.2 Working of Dot Matrix Printer

In a dot matrix printer, the characters and letters are formed by a matrix of dots. A print head, which has many pins in it, moves in the required direction and strikes against a cloth ribbon which is soaked in ink, making a mark on the paper. The dots are spaced closely in a particular shape to make the intended character. This looks quite similar to the printing mechanism of typewriters and daisy wheel printers. However, dot matrix printers are different in the sense that many different characters and graphics can be printed. A character printed by a DMP is actually an accumulation of many such dots on a small area of the paper.

2.3. Working of Ink Jet Printer

In the inkjet printing mechanism, the print head has several tiny nozzles, also called jets. As the paper moves past the print head, the nozzles spray the ink onto it, forming the characters and images. There is usually one black ink cartridge and one so-called color inkjet cartridge containing ink in primary pigments (cyan, magenta and yellow). Some inkjet printers use a single cartridge with cyan, magenta, yellow and black ink. A few models require separate cartridges for each primary pigment, along with a black ink cartridge.



3.Working Mechanism of Touch Screen Panel:

A Touch screen is an electronic visual display capable of detecting and locating a touch over its display area. This is generally referred to as touching the display of the device with a finger or hand. This technology most widely used in computers, user interactive machines, smartphones, tablets, etc to replace most functions of the mouse and keyboard.

A touch screen technology is the assembly of a touch panel as well as a display device. Generally, a touch panel is covered on an electronic visual display within a processing system.

A basic touch screen is having a touch sensor, a controller, and a software driver as three main components. The touch screen is needed to be combined with a display and a PC to make a touch screen system.

Touch Sensor

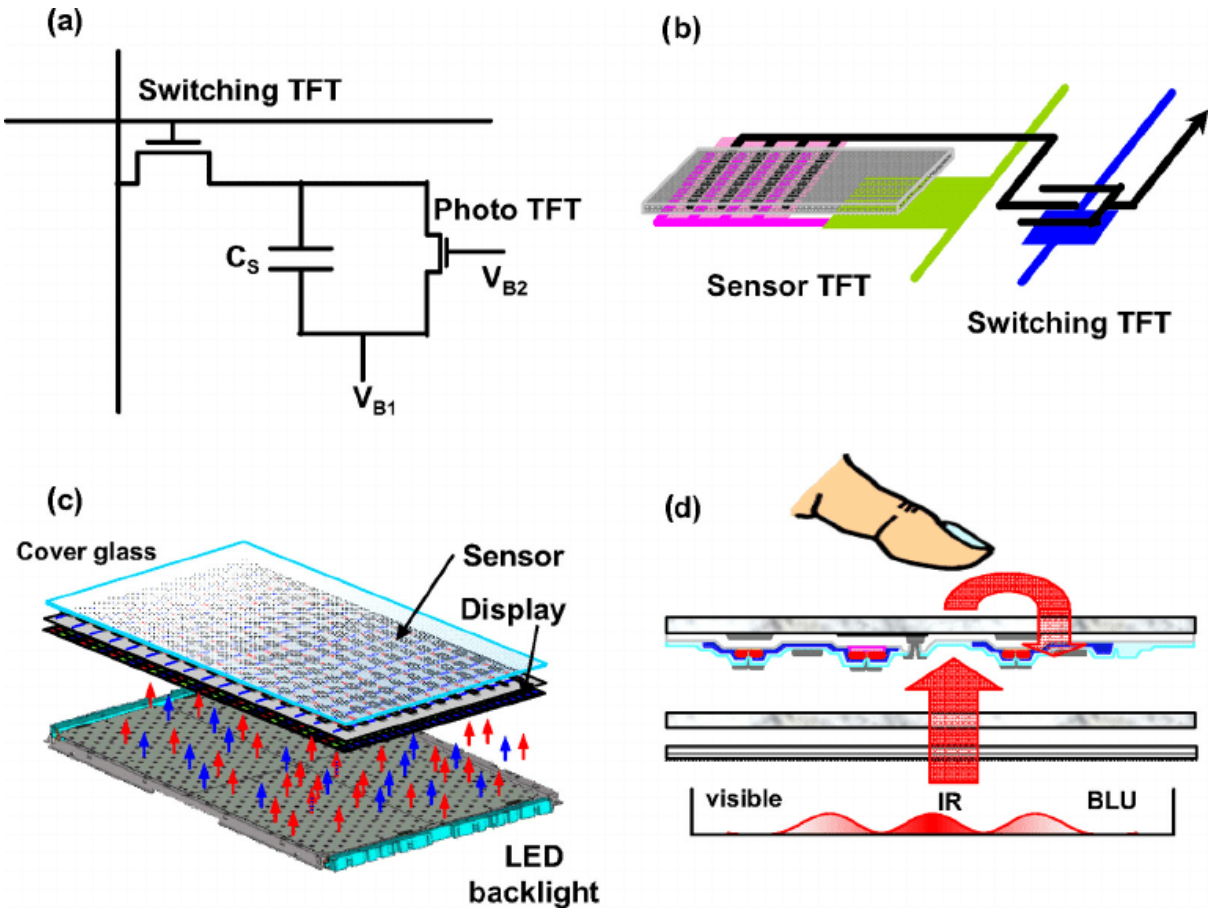
The sensor generally has an electrical current or signal going through it and touching the screen causes a change in the signal. This change is used to determine the location of the touch of the screen.

Controller

A controller will be connected between the touch sensor and PC. It takes information from the sensor and translates it for the understanding of PC. The controller determines what type of connection is needed.

Software Driver

It allows computers and touch screens to work together. It tells OS how to interact with the touch event information that is sent from the controller.


(a)
Switching TFT
Photo TFT
C_S
V_{B2}
V_{B1}
(b)
Sensor TFT
Switching TFT
(c)
Cover glass
Sensor
Display
LED
backlight
(d)
visible
IR
BLU