

## 4. Input and Output Devices

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### 4.1 Introduction of input devices

WHAT IS INPUT?

Input is any data or instructions entered to the computer. Input can be in the form of audio, video, graphics and animations and instructions

WHAT ARE INPUT DEVICES?

Any hardware component used to enter data, programs, commands, and user responses into a computer

Examples: Key Board, Mouse, Digital Camera, Webcam, Scanner, etc.



#### 4.1.1 Pointing Devices

A pointing device is an input device which is used to control a pointer on a screen. Pointer is a small symbol on a screen.

A pointing device is an input interface (specifically a human interface device) that allows a user to input data to a computer. Graphical user interfaces (GUI) allow the user to control and provide data to the computer using physical gestures — point, click, and drag — for example, by moving a hand-held mouse across the surface of the physical desktop and activating switches on the mouse. Movements of the pointing device are echoed on the screen by movements of the pointer (or cursor) and other visual changes.

### **Mouse:**

“Mouse is an input device that fits under palm of hand and Controls movement of pointer”.

The mouse is a palm-size device with a ball built into the bottom. The mouse is usually connected to the computer by a cable (computer wires are frequently called cables) and may have from one to four buttons (but usually two). Mouse comes in many shapes and sizes.

When you move the mouse over a smooth surface, the ball rolls, and the pointer on the display screen moves in the same direction.

With the mouse, you can draw, select options from a menu, and modify or move text. You issue commands by pointing with the pointer and clicking a mouse button.

### **TYPES OF MOUSE**

There are three types of mouse

1. Mechanical mouse
2. Optical mouse
3. Wireless mouse

#### **MECHANICAL MOUSE:**

The mouse that contains a metal or rubber ball on its under side. When the ball is rolled in any direction, sensors inside the mouse detect this motion and move the on-screen mouse pointer in the same direction (picture above).

#### **OPTICAL MOUSE:**

An optical mouse uses a light-emitting (laser) to detect movement relative to the underlying surface.

#### **WIRELESS MOUSE:**

Wireless mouse usually work via radio frequencies commonly referred to as RF. RF wireless mouse require two components to work properly a radio transmitter and a radio receiver.

### **Trackball:**

A trackball is like an upside-down mouse. Used similarly to the mouse, the trackball is frequently attached to or built into the keyboard.

The main advantage of a trackball is that it requires less desk space than a mouse.



Early alternatives, such as trackballs clipped to the side of the keyboard, have not proved satisfactory. The IBM ThinkPad replaces the trackball with a red plastic button, called a track point, located in the middle of the keyboard. You move the button with your thumbs.

### **Joystick:**

A joystick is a pointing device often used for playing games. The joystick has a gearshift-like lever that is used to move the pointer on the screen.

On most joysticks, a button on the top is used to select options. In industry and manufacturing, joysticks are used to control robots. Flight simulators and other training simulators also use joysticks.



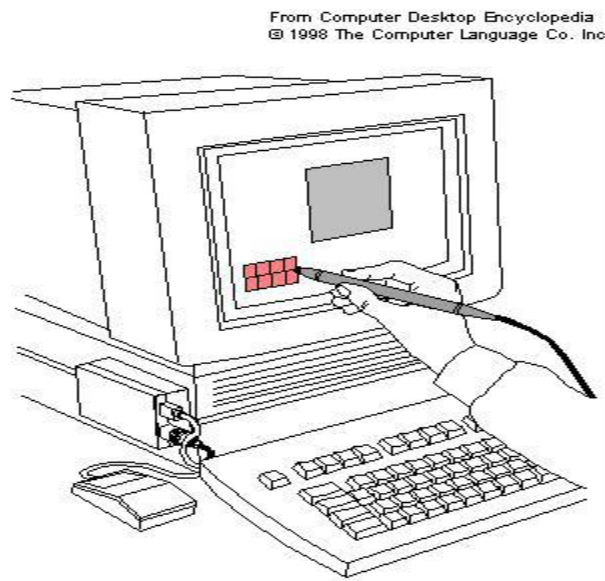
### **Touch Screen:**

A touch screen is a computer display screen that is also an input device. The screens are sensitive to pressure; a user interacts with the computer by touching pictures or words on the screen.

### **Light Pen:**

A light-sensitive stylus wired to a video terminal used to draw pictures or select menu options. The user brings the pen to the desired point on screen and presses the pen button to make contact.

When the user presses the button, the pen senses light, and the pixel being illuminated at that instant identifies the screen location.

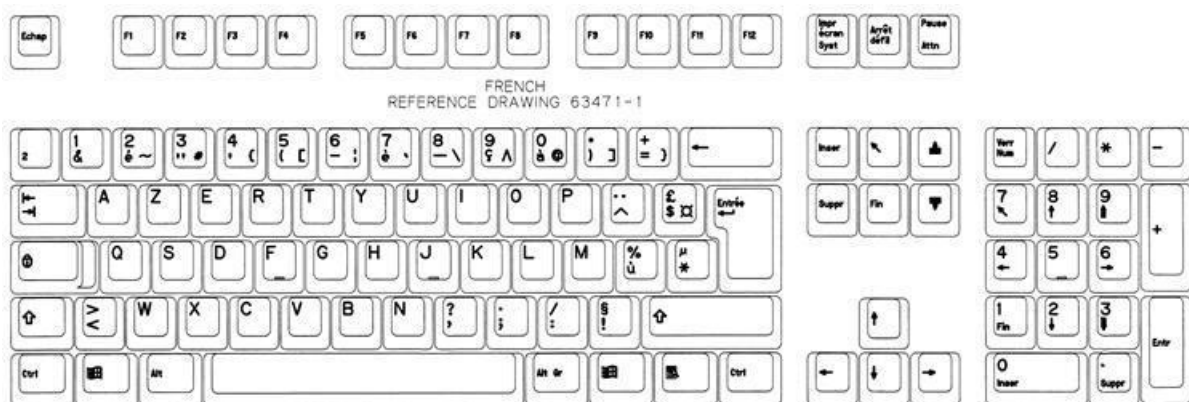


#### 4.1.2 Keyboard

“Keyboard is an input device, that contains keys user press to enter data or instructions in to the computer”.

You enter most input data into the computer by using a keyboard. This input method is similar to typing on a typewriter.

Most typewriter and computer keyboards are QWERTY keyboards. The alphabetic keys are arranged so that the upper-left row of letters begins with the six letters Q W E R T Y. Designers of other keyboards claim that their boards are easier to learn than the QWERTY keyboard.



## KEYS OF KEYBOARD

Computer keyboards include keys that are designed to perform specific tasks. These keys enable the user to perform complex tasks easily when using the application. For example, many applications use a function key to access online help for the user.

Keyboard keys consist of

- Alphabetic keys
- Numerical keys
- Symbols
- Functional keys
- Extra keys

Alphabetic keys contain alphabets from A-Z & a-z

Numerical keys contain numbers 0-9

symbols keys contain many symbols like !, @, #, \$, % etc.

Functional keys contain f1-f12, design for special purpose will discuss latter.

Extra keys contain Esc, Alt, Ctrl, Backspace, Enter etc.

### 4.1.3 RFID Concepts and Application in Fast Tag

#### **Fast Tag:**

FASTag – A smarter way of Toll Collection.

In India, the concept was decided to implement in the month of April 2013 and the Scheme of 'One Nation One FASTag' came into force on 15 December 2019.

To prevent the overcrowding of traffic, air pollution and to ensure a smooth transportation on National highway's Toll plazas, the NPCL (National Payments Corporation of India) has introduced FASTag as a nationwide Electronic Toll Collection solution which has become compulsory on Fastag-only lanes and presently it is operational at 240 plus toll plazas across national & state highways.

FAS Tag is a vehicle-specific and RFID Technology-based device which enables digital cash transaction for paying toll-fare while being a vehicle in motion. It is an RFID tag fixed on the windscreen of a vehicle which enables electronic toll collection immediately from the registered bank account of the car owners without stopping them for payment.



## RFID:

RFID is a technology behind Fastag which uses radio frequency waves to track the items and transfer the data without being in contact by reading and capturing the information stored on a tag which is attached to the object.

RFID tags consist of – tags or labels which are rooted with a transmitter and a receiver, an antenna which transmits and receive a signal, a microchip to processes and stores the information and an interrogator (two-way radio transmitter and receiver) which transmit the results to an RFID computer program.

When the vehicle reaches the toll plaza, the RFID antenna at the top of the toll gate scans the tag identification number and the QR code and then lifts the barriers to allow a vehicle to pass through.

## Types of RFID tags:

**Passive RFID tags** (used in FASTag): Passive RFID tags are those tags which operate without a battery and get power supply from the electromagnetic energy transmitted by the RFID reader.

**Active RFID tags** (battery-powered): Active RFID tags operate through a small battery that powers the relay of information. These have a short time span and need to be replaced when the battery dies.

## RFID Applications:

- Inventory management
- Asset tracking
- Personnel tracking
- Controlling access to restricted areas
- ID Badging
- Supply chain management

### **FASTag Benefits:**

- It is a reloadable tag which is simple to use.
- Reduces the overcrowding and waiting time at toll plazas.
- Prevents air pollution which occurs due to congestion around toll plaza.
- Facilitate ease of transaction through digital payment of toll-fare.
- Saves the travel time and fuel consumption.
- Provide secure interoperable framework applicable across the country.
- Eco-friendly initiative as it reduces pollution and use of paper.
- Better highway management and reduced efforts in managing toll plaza.
- A web portal for all the customers to access their statements of transaction by logging on the FASTag customer portal.
- SMS alerts for the transactions on the registered mobile number of the customer.
- Online recharge facility by using any of the authorized method of payments and bank linked to the FASTag.

## **4.2 Introduction and purpose of Scanning Devices**

### **4.2.1 Optical Scanner**

An optical scanner is an input device using light beams to scan and digitally convert images, codes, text or objects as two-dimensional (2D) digital files and sends them to computers and fax machines.

#### **Optical Character Reader (OCR)**

OCR is an input device used to read a printed text.



OCR scans the text optically, character by character, converts them into a machine readable code, and stores the text on the system memory.

It converts bitmap image of characters in to equivalent ASCII code which means:



1. Scanner first creates the bitmap image of the document.
2. Then OCR software translates it to ASCII text that computer can interpret as letters, numbers and special characters.

### **Optical Mark Reader (OMR)**

OMR is a special type of optical scanner used to recognize the type of mark made by pen or pencil. It is used where one out of a few alternatives is to be selected and marked.



It is specially used for checking the answer sheets of examinations having multiple choice questions.

### **4.2.2 Bar Code Readers**

Bar Code Reader is a device used for reading bar coded data (data in the form of light and dark lines). Bar coded data is generally used in labelling goods, numbering the books, etc. It may be a handheld scanner or may be embedded in a stationary scanner.



Bar Code Reader scans a bar code image, converts it into an alphanumeric value, which is then fed to the computer that the bar code reader is connected to.

### **4.2.3 Web camera**

A webcam is a small digital video camera that connects to a computer. It is also known as a web camera that can capture pictures or motion video.



These cameras come with software that needs to be installed on the computer that helps transmit its video on the Internet in real-time. It has the ability to take pictures, including HD videos, but its video quality can be lower as compared to other camera models.

A webcam captures digital pictures as it is an input device. These images are forwarded to the computer that moves them to a server. Then, these pictures can be transmitted to the hosting page from the server. Nowadays, most of the webcam is connected to the USB or FireWire port on the computer or embedded into the display with laptop computers.

### **Features of Web camera**

The webcams can differ in terms of size, shape, specification, and price. There are several features of webcam that help you choose the best webcam for your individual needs:

#### **1. Megapixels**

The megapixels are very small dots of colour that makes a visual image when they are combined. Accordingly, a webcam produces a clearer bright image with more megapixels. Although a webcam with 320X240 or 640X480 pixels provides a better image. Also, the 1280X720 pixels are considered a better specification for your webcam to produce high definition (HD) quality.

#### **2. Frame Rate**

As the megapixels control the image and color brightness, the frame rate deals with the video quality, which decides how many images per second are displayed. At least the frame rate in a reasonable webcam will have 30 frames per second. If the frame rate is less than 30fps, this is out of date, and images may shake and vibrate. A webcam that supports 60 fps recording can provide a higher quality moving image or smoothest video.

#### **3. Lens Quality**

In the video process, the lens is the first stage. Therefore, it is most important that your camera has the correct lens for full filling your requirements.

#### **4. Autofocus**

There can be a lot of activity happening during a webcam session in many scenarios; autofocus is a feature that works by automatically focusing the subject, while it moves around.

#### **5. Low Light Quality**

Sometimes, if you need to use your webcam in the evening or in low light conditions, the image quality can be very poor.

#### **6. Resolution**

A resolution is an important aspect in pictures or videos, although many webcam support 720p and 1080p high-definition quality. Also, some webcams come to have 4k capability, but they come with a premium price tag. A webcam with a resolution between 1.3MP and 2.0MP can provide you clear pictures.

### **Applications of Web camera:**

- Buildings
- Banking sector
- Video calling
- Home security system
- Roads and parking areas

## 4.3 Introductions and comparisons of Output devices

### 4.3.1 Monitors

A monitor is an electronic output device that is also known as a video display terminal (VDT) or a video display unit (VDU). It is used to display images, text, video, and graphics information generated by a connected computer via a computer's video card.

#### Types of monitors:

##### 1. CRT monitors (Cathode Ray Tube)

It is a technology used in early monitors. It uses a beam of electrons to create an image on the screen. It comprises the guns that fire a beam of electrons inside the screen.

The electron beams repeatedly hit the surface of the screen. These guns are responsible for generating RGB (Red, Green, Blue) colors, and more other colors can be generated with the help of combining these three colors. Today's Flat Panel Monitors replace the CRT monitors.



##### 2. LED monitors (light-emitting diode)

LED monitor is a flat screen computer monitor, which stands for light-emitting diode display. It is lightweight in terms of weight and has a short depth.

As the source of light, it uses a panel of LEDs. Nowadays, a wide number of electronic devices, both large and small devices such as laptop screens, mobile phones, TVs, computer monitors, tablets, and more, use LED displays.



### 3. LCD monitors (liquid-crystal display)

The LCD monitors bring lots of advantages when compared to the CRT ones. The first advantage which is also the most obvious one is the fact that the LCD monitors are smaller and have a smaller weight than the CRT monitors.

The LCD monitors can be placed on the table and they use far less space than the CRT monitors. This is a great advantage. The picture quality of the LCD monitors will be increased as well which means that the movies will be displayed in a better quality and the games will have better colors, and so on.



### 4. TFT monitors (thin-film transistor)

It is a type of LCD flat panel display, which stands for a thin-film transistor. In **TFT** monitors, all pixels are controlled with the help of one to four transistors.

The high-quality flat-panel LCDs use these transistors. Although the TFT-based monitors provide better resolution of all the flat-panel techniques, these are highly expensive.

The LCDs, which use thin-film transistor (TFT) technology, are known as active-matrix displays. The active-matrix displays offer higher quality as compared to older passive-matrix displays.



### **5. OLED monitors (organic light-emitting diode)**

It is a new flat light-emitting display technology, which is more efficient, brighter, thinner, and better refresh rates feature and contrast as compared to the LCD display.

These displays do not need a backlight as they are emissive displays. Furthermore, it provides better image quality ever and used in tablets and high-end smartphones.



Nowadays, it is widely used in laptops, TVs, mobile phones, digital cameras, tablets, VR headsets.

### **6. Touch Screen Monitor**

These monitors are also known as an input device. It enables users to interact with the computer by using a finger instead of using a mouse or keyboard.

When users touch the screen by their finger, it occurs an event and forward it to the controller for processing.

These types of screens include pictures or words that help users to interact with the computer. It takes input from the users by touching menus or icons presented on the screen.



### 4.3.2 Printers

Printer is an output device, which is used to print information on paper.

There are two types of printers –

1. Impact Printers
2. Non-Impact Printers

#### 1. Impact Printers

Impact printers print the characters by striking them on the ribbon, which is then pressed on the paper. These printers are of two types – Character printers, Line printers. (Dot Matrix printer)

#### 2. Non-impact Printers

Non-impact printers print the characters without using the ribbon. These printers print a complete page at a time, thus they are also called as Page Printers. (Laser printer, Inkjet printer)

#### Dot Matrix Printer

In the market, one of the most popular printers is Dot Matrix Printer. These printers are popular because of their ease of printing and economical price. Each character printed is in the form of pattern of dots and head consists of a Matrix of Pins of size (5\*7, 7\*9, 9\*7 or 9\*9) which come out to form a character which is why it is called Dot Matrix Printer.



### **Advantages**

- Inexpensive
- Widely Used
- Other language characters can be printed

### **Disadvantages**

- Slow Speed
- Poor Quality

### **Laser printers**

These are non-impact page printers. They use laser lights to produce the dots needed to form the characters to be printed on a page.



### **Advantages**

- Very high speed
- Very high quality output
- Good graphics quality
- Supports many fonts and different character size

### **Disadvantages**

- Expensive
- Cannot be used to produce multiple copies of a document in a single printing.

### **Inkjet Printers**

Inkjet printers are non-impact character printers based on a relatively new technology. They print characters by spraying small drops of ink onto paper. Inkjet printers produce high quality output with presentable features.



They make less noise because no hammering is done and these have many styles of printing modes available.

Color printing is also possible. Some models of Inkjet printers can produce multiple copies of printing also.

**Advantages**

- High quality printing
- More reliable

**Disadvantages**

- Expensive as the cost per page is high
- Slow as compared to laser printer