

UNIT STRUCTURE

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7.0 Learning Objectives :

After working through this unit, you should be able to :

- Specify the types of I/O devices and their use in computer systems
- State the basic principle of working of keyboard and its various types
- Name various types of key switches
- Enlist various types of mouse used in computer systems
- Explain the principle of working of mouse, joystick, OCRs and trackball

7.1 Introduction :

As we have discussed that the role of the computer system is to take input the data from the user, process it and produces output. To input the data to the computer system various Input devices and to obtained output from the computer

system various output devices are used. In this unit we will discuss various input devices and in the next unit we will discuss various output devices of the computer system.

7.2 Keyboard :

One of the general and most common ways to input data is by keyboard. The Keyboards convert or translate numbers, letters and special characters that people understand into electrical signals. These electrical signals are sent to and processed by the system unit.

There are wide varieties of different keyboard designs. They range from the traditional keyboards to ergonomic keyboards to space saving or flexible keyboards.

There are four types of keyboards on basis of type of key switch – Mechanical, Membrane, and Capacitor and Hall Effect keyboards. Let us discuss these types :

❖ **Mechanical Keyboard :**

As the name suggested, the mechanical keyboard comprises of mechanical key switches. In mechanical switch keys, two pieces of metal are pushed together when the key is pressed. The switch elements are made up of phosphor bronze alloys with gold plating on contact areas. The key switch is provided with a spring to return the key to the non–pressed position. The small piece of foam is provided to help damp out bouncing.

Advantage : The main advantage is a low cost.

Disadvantage :

1. The mechanical key switches suffer from contact de–bounce. The pressed key may make and break contact several times before it makes a solid contact.
2. Over the period of aging, the contacts may become oxidized or dirty. As a result, the key switches become sluggish and insensitive.

Life : The life of higher–quality mechanical key switches is about 1 million keystrokes.

❖ **Membrane Keyboard :**

The membrane key switches comprise of three–layer plastic or rubber sandwich. The top layer has a conductive line of silver ink running under each row of keys. The middle layer has a hole under each key position. The bottom layer has a conductive line of silver ink running under each column of keys.

When you press the key, you push top ink line through the hole to contact the bottom ink line.

Advantage : The advantage of such type of keyboards is that they can be made very thin, sealed units.

Disadvantage : These keyboards have a limited usage. You have seen these keyboards in mobile phones, calculators, billing machines etc. However, you cannot use these keyboards as general–purpose keyboards.

Life : The life of these keyboards varies over a wide range.

❖ **Capacitive Keyboard :**

As name indicates, this type of keyboard comprises of capacitive type of key switches. The capacitive key switch has two small metal plates on printed circuit board and another metal plate at the bottom of piece of foam. When you press the key, the movable plate is pushed closer to the fixed plate. This changes the capacitance between two plates. This change in capacitance is detected by the sense amplifier circuit. This generates a logic level signal that indicates that the key has been pressed.

Advantage : There are no mechanical contacts to become oxidized or dirty.

Disadvantage : The sense amplifier circuit should be able to identify the key closure at all the times.

Life : The life of capacitive key switches is about 20 million keystrokes.

❖ **Hall Effect Keyboard :**

The other type of key switch has no mechanical contacts. It takes advantage of deflection of moving charge by a magnetic field.

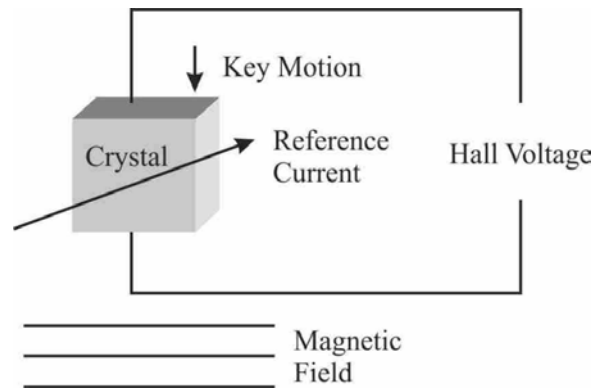


Fig. 7.1 : Hall Effect Keyboard

The working of the Hall Effect key switches is shown in Fig. 7.1. The reference current is passed through a semiconductor crystal between two opposing faces. When the key is pressed a crystal is moved through a magnetic field which has its flux lines perpendicular to the direction of current flow in the crystal. Moving crystal through magnetic field causes a small voltage to be developed between two of the opposing faces of the crystal. This voltage is amplified and used to indicate that the key is pressed.

Advantage : There are no mechanical contacts to become oxidized or dirty.

Disadvantage : Hall Effect keyboards are more expensive because of more complex switch mechanisms.

Life : The life of capacitive key switches is about 100 million keystrokes.
Working of Key Board (How computer accepts input from Keyboard)

The working of keyboard takes place as shown in the functional block diagram. (Fig 7.2)

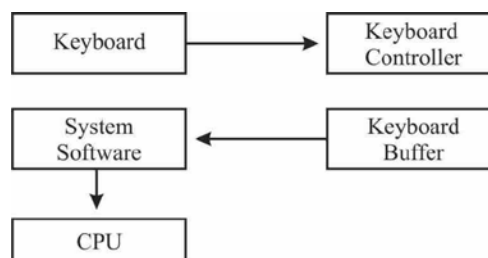


Fig. 7.2 : Working of a keyboard

The various steps are as follows :

1. The key is pressed on keyboard.
2. The scan code sent by keyboard controller for the key to the keyboard buffer.
3. The interrupt request sent by keyboard buffer to the system software.
4. System software then responds to the interrupt by reading scan code from the buffer of the keyboard.
5. Then the system software passes the scan code towards the CPU.

When you press any key on keyboard, the chip keyboard controller comes to know that the key is pressed. The keyboard controller places a code corresponding to pressed key, into part of its memory unit is known as keyboard buffer. Buffer is mainly a temporary storage area that holds data until it can be processed. Then, the keyboard controller delivers a signal to the system software. When the system software gets or receive signal to generate relevant response, the keystroke occurs to the system that reads the memory location in the keyboard buffer which contains code of the key that was pressed. The system software then sends that code to CPU.

The keyboard buffer can store many keystrokes at a time. This is necessary because sometimes, there are elapses between pressing of the key and computer's reading of that key from the keyboard buffer. With keystrokes stored in the buffer, the program can react with them when it is convenient.

❖ IBM Enhanced Keyboard :

The keyboard conforming to IBM standard is known as IBM enhanced Keyboard. The keyboard has about 100 keys. Each key when pressed generates a separate signal for CPU. The 100 keys are arranged in five groups. The keys on keyboard are having following sections :

1. **Alphanumeric Keys :** This section comprises of alphabetical keys viz. A, B, C Z and numeric keys viz. 0, 1, 2...9
2. **Modifier Keys :** The SHIFT, ALT (Alternate) and CTRL (Control) keys are called Modifier Keys, because they modify input received from the other keys.
3. **Numeric Keypad :** It is located at the right side of the keyboard. It looks like a calculator's keypad. It has 10 numeric keys and mathematical operator keys (+, -, * and /). The numeric key pad can be activated by using NUM LOCK key.
4. **Function Keys :** There are 12 function keys viz. F1, F2, F3.... F12, situated at top of the keyboard. Each key has a purpose as per program being used. Usually F1 key gives help menu.
5. **Cursor Movement Keys :** The four arrow keys are provided for movement of cursor on the screen. These four keys are up, down, right and left arrow keys.
6. **Special Purpose Keys :** The special keys provided are ESC, Print Screen, Pause, Insert, Delete and Scroll lock.

❑ **Check Your Progress – 1 :**

1. How many Function Keys are available on the keyboard ?
[A] 9 [B] 12 [C] 22 [D] 11
2. Identify the Identifier Keys from the given below :
[A] CTRL [B] ALT [C] SHIFT [D] All of these
3. In _____ keyboard keys are made from three-layer plastic or rubber.
[A] Hall Effect [B] Capacitive [C] Mechanical [D] Membrane

7.3 Pointing Devices :

Pointing devices provide an interface with the system unit by accepting point gestures and converting them into machine readable input. There are wide variety of different pointing devices including mouse, joystick, touch screen and light pen. While the most frequent pointing device by far is the mouse, and many more devices have been developed.

7.3.1 Mouse :

In early 1980s, when the Personal Computer was introduced, it was having only keyboard as the main input device. The pointing device was not much required in those days. However, the requirement of mouse was realized as new software's came in. Today, mouse has become an integral part of the computer system.



Fig. 7.3 : Mouse

The various events performed on mouse are click, double click, right click, drag and drop.

The main components of mouse are as follows :

1. **Left Button :** It involves two events – single click and double click. Single click on item on monitor to select it. Double click to perform an action.
2. **Right Button :** Single right clicking on the object displays a short cut menu of options.
3. **Mouse Cable :** It connects and sends electronic signals from mouse to system unit.
4. **Roller Ball :** It converts movement of mouse into electronic signals.

You can configure mouse properties. For example, you can change the shape of a mouse pointer. Select start > settings > control panel > mouse. The dialog box "mouse properties" will appear on the screen. The various options are buttons, pointers, pointer options, Hardware, activities and wheel. Select the required option for configuration.

- A. **Mechanical Mouse :** Is the most common type of point device. It contains a small rubber ball that protrudes through a hole in the bottom of mouse body. A ball rotates inside the case as you move the mouse around on flat surface. Inside the mouse, rollers, sensors send or deliver signals to the computer telling it the distance, direction and speed of the ball's motion. The computer uses this data to point the mouse pointer on the screen.
- B. **Optical Mouse :** This mouse is a non-mechanical type of mouse. This type of mouse uses a light-emitting diode and photodiodes to detect movement relative to the underlying surface, rather than internal moving parts as other mechanical mouse does. It emits a beam of light from its underside; it uses

light's reflection to judge the distance, direction and speed of travel. The optical mouse offers two benefits :

1. Without using cursor movement keys, the mouse lets you position the cursor anywhere on the screen quickly. Then you move the pointer to the on-screen position you want and press the mouse button, the cursor display at that location.
2. Instead of forcing to type or issue commands from keyboard, the mouse-based operating system allows you to use menus and dialog boxes.
3. Compared to mechanical mouse, the optical mouse is maintenance free. It does not require periodic cleaning.
4. The optical mouse is more precise as compared to the mechanical mouse.

C. Wheel Mouse : This type of mouse has a small wheel among its buttons. This wheel can be used for scrolling through a long document. Not all applications and operating systems support the use of wheel.

Cordless or wireless mouse is a battery powered device that uses radio waves or infrared light waves to communicate with the system unit. This type of mouse eliminates mouse cord and free up desk space. A cordless mouse frees you from cord problems. It connects to your computer with a radio (rather than an infrared) signal, powered by two AAA batteries.

□ Check Your Progress – 2 :

1. _____ is a pointing device.
[A] Keyboard [B] Monitor [C] Printer [D] Mouse
2. To change the mouse setting, you need to open _____ of the system.
[A] Device Manager [B] Disk Manager
[C] Control Panel [D] Programs
3. A _____ mouse has a small rubber ball that protrudes through a hole in the bottom of mouse body.
[A] Mechanical [B] Optical [C] Wireless [D] All of the above

7.3.2 Track Balls :

This is a pointing device similar to mouse are trackballs, touch surfaces and pointing sticks. It is a pointing device which looks like an upside-down mouse with an exposed protruding ball. The user rolls the ball with the thumb, fingers, or the palm of the hand to move a cursor. You can use trackball (also called roller ball) to control pointer by rotating ball with your thumb. A touch surface (track pad) is a pointing device consisting of specialized surface that can translate the motion and position of a user's fingers to a relative position on screen. You can also use touch surfaces to control the pointer by moving and tapping you finger on surface of a pad. You can use pointing stick located in the middle of a keyboard to control the pointer by directing the stick with your finger.

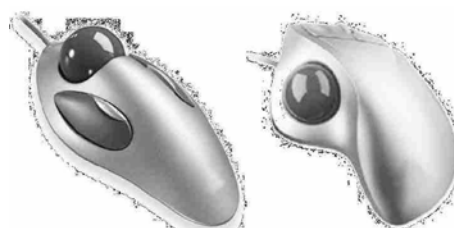


Fig. 7.4 : Track ball

7.3.3 Joy Stick :

Joystick is the most commonly used input device for computer games. The game actions are controlled by varying pressure, speed and direction of Joystick. Additional controls such as buttons and triggers are used to specify commands or initiate specific actions. The joystick has been the principal flight control in the cockpit of many aircraft, particularly military fast jets.

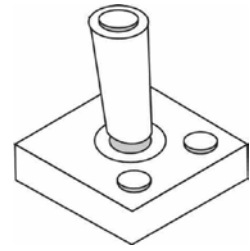


Fig. 7.5 : Track ball

7.3.4 Touch Screen :

It is a particular kind of monitor screen covered with a plastic layer. Behind this layer are crisscrossed invisible beams of infrared light. This arrangement enables someone to select actions or commands by touching the screen with finger.

Touch screens are easy to use, especially when people need information quickly. These types of displays can be attached to computers or to networks as terminals. These are commonly used at restaurants, automated teller machines (ATMs) and information centres.

7.3.5 Light Pen :

Light pen is light sensitive pen like device. A light pen is a computer input device in the form of a light-sensitive wand used in conjunction with a computer's CRT TV set or monitor. It allows the user to point to displayed objects, or draw on the screen. The light pen is placed against the monitor. This closes photoelectric circuit and identifies the spot for entering or modifying data. Light pens can be used to do graphical representations on a computer. For example, light pens are used to edit digital images.

❑ Check Your Progress – 3 :

- _____ is the most commonly used input device for computer games.
[A] Mouse [B] Track ball
[C] Joystick [D] None of the above
- _____ input device is similar to mouse, having a ball to point the object on the screen.
[A] Mouse [B] Track ball [C] Joystick [D] Touch screen
- In a mobile or tablet, _____ is used as an input device.
[A] Mouse [B] Track ball [C] Joystick [D] Touch screen
- _____ is optics sensitive, input pointing device.
[A] Mouse [B] Light pen [C] Joy stick [D] Touch screen

7.4 Scanning Devices :

Scanners read data or information from source and which can be a written document, inventory card, price tag, photograph or picture. A scanning device reads data or information and converts it into a form that the computer can process. There are three types of scanning devices : Optical scanners, bar code readers and character and mark recognition devices.

7.4.1 Optical Scanners :

The optical scanner copies or reproduces text as well as images. These devices record light as well as dark areas and also colour of the scanned document. After scanning the image, it can be displayed, printed on paper and stored in memory. There are two categories of optical scanners – Flatbed and portable.

Flatbed scanner is similar to a copying machine. The image which is to be scanned is placed on the glass surface above the scanner which records image from below.

Portable scanner is a type of hand-held device that slides across the image making a direct contact.

The optical scanners are used widely in the world. These are the powerful tools for a wide variety of end users. This includes advertising and graphic professionals who scan images and combine with text. Lawyers and students use portable scanners as a valuable research tool to record information.

7.4.2 Bar-Code Readers :

As we all have seen bar code readers at different stores. Wand readers or platform scanners are photoelectric scanners that read the bar codes or vertical zebra-stripped marks, printed on product containers. The electronic cash registers are used in supermarkets. There the bar code system is called Universal Product Code (UPC). The bar code identifies product to the supermarket's computer which has a description and least price for the product. The computer automatically tells electronic cash register, the price of the product. These devices are easy to operate and user friendly.



Fig. 7.6 : Bar-Code Reader

Character and Mark Recognition Devices :

These are the scanners that are able to recognize special characters and marks. They are the special devices that are essential tools for certain applications. There are following three types of Character and Mark Recognition Devices :

1. **Magnetic Ink Character Recognition (MICR) :** It is used in banks to automatically read the MICR Number printed at the bottom of the cheque. It is read by special purpose machine known as reader / sorter which reads characters. These characters are made by ink containing magnetized particles.
2. **Optical Character Recognition (OCR) :** The pre-printed characters can be read by the light source and can be converted into a machine-readable code. The common OCR device is a hand-held wand reader. These are used in the departmental stores to read retail price tags by reflecting light on the printed characters.
3. **Optical Mark Recognition (OMR) :** It is also called mark sensing. An OMR device senses whether the mark as pencil mark is present or absent. The OMR technique is used in evaluation of competitive examination performance. This technique is used for evaluating marks in examinations such as Graduate Record Examination (GRE), Scholastic Aptitude Test (SAT) etc.



Fig. 7.7 : Optical Mark Recognition

❑ **Check Your Progress – 4 :**

1. OMR Stands for _____.
[A] Object Machine Reader [B] Optical Machine Reader
[C] Optical Mark Recognition [D] Optical Mark Resolution
2. To process the cheques, _____ is used.
[A] OMR [B] OCR
[C] MICR [D] None of the above
3. _____ is used to read UPC.
[A] Bar-code reader [B] MICR reader
[C] Flatbed scanner [D] OMR reader

7.5 Cameras :

7.5.1 Digital Camera :

Optical scanners, like traditional copying machines, can make a copy from an original object. For example, we can copy a photograph by using optical scanner. Digital camera is an image capturing device which creates or captures original images. Digital camera is similar to traditional camera except that the images are recorded digitally. The images are stored in the memory of the camera or on the disk and not on the film itself. We can take a picture, view it instantly, store it in a memory and place it on web page. This can be done immediately.



Fig. 7.8 : Digital Camera

Digital cameras are now available at low cost. Using digital camera and special software, you can edit photographs on computer. The digital cameras work much like a regular camera with a value addition of capturing and digital storage of images internally. Typically, photographs are transferred to the computer through USB port. These photographs are read through PC software. This software can further be used to edit, print, e-mail and archive the photographs.

7.5.2 Web Camera :

Web camera is the Digital video camera. It is the other kind of image capturing device. Unlike traditional video cameras the web camera record motion digitally in the memory of the camera or on the disk. The Webcams capture images which can be sent to a computer across the globe using the internet.



Fig. 7.9 : Web Camera

Graphic tablets and digital notebooks :

Graphic tablets and digital notebooks are digitizing devices. Using digitizing devices, the diagram can be converted into the form that is process-able by the computer. These devices are provided with a flat surface and writing device. As the user moves writing device across the surface, the digitization device records the movement as a series of points and sends this information to the computer. The Graphic tablets comprise of the special graphics surface or tablet and special stylus or a pen like device. The user draws a diagram directly on the tablet or traces images that are placed on the tablet. These devices are widely used by artists, draftsman and engineers. Artists create pictures, draftsman creates maps and engineers digitally save the mechanical drawings.

Digital notebooks : The digital notepad is positioned on the top of the tablet. Using a regular pen, the user takes notes and creates drawings on the notepad. The underlying electronic pad records the movements. Later, the notes taken by the user can be processed, edited and used with a word processing program.

7.6 Voice Recognition Systems :

The Voice Recognition Systems are the audio input devices which convert sound into the form that can be read and processed by the computer. The most commonly used audio input device is the microphone. Microphone is the main part of Voice Recognition Systems. Other components are sound card and special software. Using this system, the document with voice command can be created. It is an input system that uses a microphone (or a telephone) as an input device and converts a person's speech into digital signals by comparing the electrical patterns produced by the speaker's voice with a set of pre-recorded patterns stored in the computer. Voice-recognition technology is useful in situations where people are unable to use their hands to input data or need their hands free for other purposes. Some Voice Recognition Systems can translate dictation taken from language to other language. For example, it is possible to translate from English to Japanese.

□ Check Your Progress – 5 :

- _____ is similar to traditional camera except that the images are recorded digitally.

[A] Web camera	[B] Digital camera
[C] Scanner	[D] Telescope
- _____ is use for dictation.

[A] OMR	[B] OCR
[C] VRS	[D] None of the above

3. _____ hardware is essential for Voice Recognition System.
[A] Microphone [B] Speaker [C] Web camera [D] Digital camera

7.7 Let Us Sum Up :

In this unit :

- We have learnt about various Input devices.
 - We have discussed different types of key boards.
 - We have also seen different types of pointing devices like Mouse, Trackball, Light-pen etc.
 - We have learnt how a hard-copy is converted into the soft-copy using scanners. We have discussed type of scanners.
 - We have seen special type of scanners like MICR, OCR and OMR type of devices.
 - We have also seen how different types of Cameras can be used for taking input to the computer.
 - Finally, we have ended our discussion with Voice Recognition System.
- Input Devices

7.8 Suggested Answers For Check Your Progress :

❑ Check Your Progress 1 :

1. [B] 2. [D] 3. [D]

❑ Check Your Progress 2 :

1. [D] 2. [C] 3. [A]

❑ Check Your Progress 3 :

1. [C] 2. [B] 3. [D] 4. [B]

❑ Check Your Progress 4 :

1. [C] 2. [C] 3. [A]

❑ Check Your Progress 5 :

1. [B] 2. [C] 3. [A]

7.9 Glossary :

OMR : Optical Mark Recognition. It is a technology used to evaluate answer script of objective type of examination.

MICR : Magnetic Ink Character Recognition. It is a technology used in the banks to process checks.

OCR : Optical Character Recognition. It is a technology to identify character from the image of character.

UPC : Universal Product Code

7.10 Assignment :

1. Discuss the working of keyboard with functional block diagram. What do you mean by IBM enhanced key board ?
2. What are Character and Mark Recognition Devices ? Discuss their various types

❖ **Short Notes :**

- a. Working of mouse
- b. Various types of mouse
- c. Various types of scanning devices
- d. Light pen
- e. Joystick

7.11 Activity :

Explain in brief any five input devices along with their uses.

7.12 Case Study :

- Find how Google assistant is working on the Internet and write short description on it.

7.13 Further Reading :

1. Computer Fundamentals by P.K.Sinha and Priti Sinha.
2. Discovering Computers 2016 by Shelly Cashman Series. CENGAGE publications.
3. Computer Fundamentals by Pearl Software, Khanna Book Publishing.