INPUT DEVICES: Introduction

A computer interacts with the external environment via the input-output (I/O) devices attached to it. Input device is used for providing data and instructions to the computer. After processing the input data, computer provides output to the user via the output device. The I/O devices that are attached, externally, to the computer machine are also called peripheral devices. Different kinds of input and output devices are used for different kinds of input and output requirements. In this chapter, we shall discuss different kinds of input devices..

Input Unit

➢ The input unit gets the data and programs from various input devices and makes them available for processing to other units of the computer.

➢ The input data is provided through input devices, such as—keyboard, mouse, trackball and joystick. Input data can also be provided by scanning images, voice recording, video recording, etc.

➢ Irrespective of the kind of input data provided to a computer, all input devices must translate the input data into a form that is understandable by the computer, i.e., in machine readable form. The transformation of the input data to machine readable form is done by the input interface of input device.

In brief, the input unit accepts input data from the user via input device, transforms the input data in computer acceptable form using input interface for the input device and provides the transformed input data for processing.

In addition to input devices and output devices, some devices function as both input and output devices. The I/O devices provide the input to computer as well as get output from computer. The I/O devices are used by both the input unit and the output unit. Hard disk drive, floppy disk drive, optical disk drives are examples of I/O devices.

Input Devices:

❖ Human data entry devices
   Keyboard
   Pointing devices—mouse, trackball, joystick
   Pick devices—light pen
❖ Source data entry devices
   Audio input— Microphone (speech recognition)
   Scanner
   Optical Scanner—OCR, OMR, MICR, barcode reader

The input is provided to the computer using an input device, and must be translated to a form that the computer can understand. The translation is done by the input interface of the input device.

In addition to the above devices, the input to a computer can also be provided from a storage device on the computer, another computer, or another piece of equipment, such as a musical instrument, thermometer or sensors.

HUMAN DATA ENTRY DEVICES

Input devices that require data to be entered manually to the computer are identified as human data entry devices. The data may be entered by typing or keying in, or by pointing a device to a particular location.

1. Keyboard

Features Keyboard is a common input device. It is provided along with the computer, and is easy to use. It is used for entering the text data. For inputting the data, the user types the data using the keyboard. When the data is being typed, the display monitor displays the typed data. Cursor is a vertical line, an underscore, blinking line, etc. Cursor moves with each typed character. The position of cursor indicates the location on monitor where the typed-in character will be displayed. A keyboard is shown in figure below.

Description The design of a keyboard is similar to a standard typewriter. The modern keyboards are QWERTY keyboard (Q, W, E, R, T, Y are the sequence of keys in top row of letters). Standard keyboard contains 101 keys which are arranged in the same order as a typewriter. The keyboard has five sections (1) Typing keys (1, 2, 3…, A, B, C…), (2) Numeric keypad (numeric keys on right side), (3) Function keys (F1, F2…. on top side), (4) Control keys (cursor keys, ctrl, alt….), and (5) Special-purpose keys (Enter, shift, spacebar…). Some keyboards have 110 keys, where the extra keys are designed to work with the Windows operating system.

Working When a key is pressed, keyboard interacts with a keyboard controller and keyboard buffer. The keyboard controller stores the code of pressed key in keyboard buffer and informs the computer software that an action has happened on the keyboard. The computer software checks and reads the keyboard buffer and passes the code of pressed character to the system software. Due to a time gap between pressing of a key on keyboard and reading by the system software, keyboard buffer is designed to store many keystrokes together.

Figure: Keyboard

2. Mouse:

Features It is the most common pointing input device. The data is entered by pointing the mouse to a location on the computer screen. The mouse may also be used to position the cursor on screen, move an object by dragging, or select an object by clicking. The key benefit of using a mouse is that the cursor moves with the mouse. So, the cursor can be positioned at any location on the screen by simply moving the mouse. Moreover, it provides an easy way to select and choose commands from menus, dialog boxes, icons, etc. Mouse is used extensively, while working with graphics elements such as line, curve, shapes, etc.

Description Mouse is a small hand-held device having two or three buttons on its upper side. In addition to the buttons, mouse also has a small wheel between the buttons. Figure below shows a mouse. The wheel of the mouse is used for the up and down movement, for example, scrolling a long document. A mouse is classified as physical mouse or optical mouse.

Figure: Mouse

Physical Mouse has a rubber ball on the bottom side that protrudes when the mouse is moved. It requires a smooth, dust free surface, such as a mouse pad, on which it is rolled.

Optical Mouse uses a Light Emitting Diode (LED) and a sensor to detect the movement of mouse. Optical mouse requires an opaque flat surface underneath it. Optical mouse was introduced by Microsoft in 1999. Optical mouse is better than physical mouse as there is no moving part that can cause wear and tear, and dirt cannot get inside it.

Working In a physical mouse, rollers and sensors are used to sense the direction and rate of movement of mouse. When the ball of mouse moves, the rollers sense the horizontal and vertical movement and sensors sense the speed of movement. This information is passed to computer via the mouse chord. When an optical mouse is moved, a beam of light is reflected from its underside. These pulses of light determine the direction and rate of movement. This information is sent to computer via the mouse chord.

Using the mouse, the mouse can be used in five different ways, as follows:

> ➢ **Pointing** points to a location or object on the computer screen. Moving the mouse by hand moves the cursor on computer screen. The cursor moves in the direction in which the mouse moves.

- ➢ **Left Click** or Click means pressing the left button of mouse and releasing it. Clicking is used to select a button, command or icon on the screen.
- ➢ **Right Click** involves pressing the right button on mouse and releasing it. Right click displays a menu that contains options like cut, copy, paste, font, paragraph, etc. for the item on which the mouse is pointing.
- ➢ **Double Click** means pressing the left button of mouse twice successively, without moving the mouse, and then releasing the mouse. It is used to start a program or open a folder.
- ➢ **Drag and** Drop drags an object and drops it at another location. Drag means pointing mouse to an object on screen, pressing the left button of mouse, keeping it pressed and moving the mouse to point to a new location. The object gets dragged to the new location along with the mouse. When the left button of mouse is released, the object gets dropped at the new location. Drag and drop is used for moving folders, files and icons to new locations on the screen.

3. TrackBall

Features Trackball is a device that is a variant of the mouse but has the functionality of mouse. It is easy to use and takes less space than a mouse. Trackball is generally built in laptops since there is no space for the mouse to move on the lap. Trackballs come in various sizes—small and big.

Description Trackball looks like an upside-down mouse. Instead of moving the whole device to move the cursor on computer screen, trackball requires the ball to be rotated manually with a finger. The trackball device remains stationary. The cursor on the computer screen moves in the direction in which the ball is moved. The buttons on trackball are used in the same way as mouse buttons. A trackball is shown in figure below.

Working Trackball works in the same way as a physical mouse.

Figure: Trackball

4. Joystick

Features Joystick (Figure below) is a device which is commonly used for playing video games. Joystick is mainly used to control the speed of the cursor and is thus popular in games involving speed like racing and flying games. The direction of push of the stick and the amount of deflection determines the change in position and the change in speed, respectively.

Description It is a stick with its base attached to a flexible rubber sheath inside a plastic cover. The plastic cover contains the circuit that detects the movement of stick and sends the information to computer. The position of the stick movement is given by the x and y coordinates of the stick.

Figure: Joystick

5. Light Pen

Features It is a light sensitive pen-like input device and is used to select objects directly on the computer screen. It is used for making drawing, graphics and for menu selection. Figures and drawings can be made by moving the pen on computer screen.

Description and Working The pen contains a photocell in a small tube. When the pen is moved on the screen, light from the screen at the location of pen causes the photocell to respond. The electric response is transmitted to the computer that can identify the position on screen at which the light pen is pointing. Figure below shows a user using a light pen on the screen.

Figure: Using a light pen

SOURCE DATA ENTRY DEVICES

Source data entry devices are used for audio input, video input and to enter the source document directly to the computer. Source data entry devices do not require data to be typed-in, keyed-in or pointed to a particular location.

1. Microphone

Audio input devices like a microphone is used to input a person's voice into the computer. A sound card (Figure below (i)) translates analog audio signals from microphone into digital codes that the computer can store and process. Sound card also translates back the digital sound into analog signals that can be sent to the speakers. Translating spoken words into text is also known as speech recognition or voice recognition. The audio input along with the software for voice recognition forms the speech recognition system or voice recognition system.
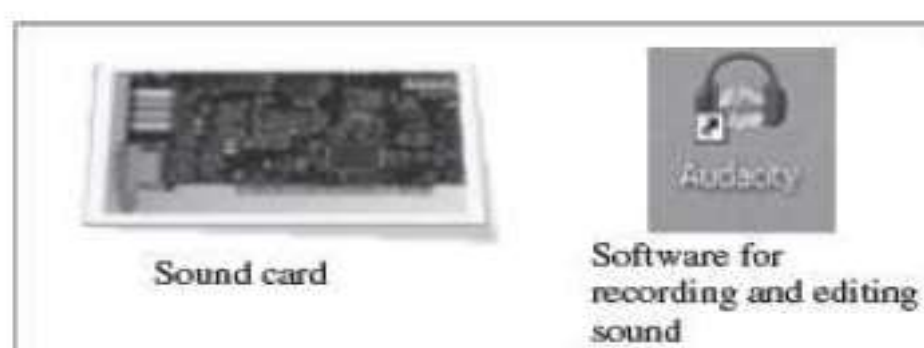

Figure: (i) Sound card   (ii) Audacity software

The computer can be operated using voice commands. The user can dictate the commands to the computer, instead of typing them. The computer has to be trained to recognize the voice of user using the speech patterns and pronunciation of words. The system thus adapts to the voice of user. Speech recognition systems are costly and difficult to develop. They are generally used by people who have difficulty in typing, people with disabilities or by corporate world for dictation. Audio input can be recorded on an mp3 recorder and provided as an input to computer. Open source software like Audacity is used for recording and editing of audio files (Figure above (ii)).

Magnetic Stripe Reader:
A magnetic stripe reader, also called a magstripe reader, is a hardware device that reads the information encoded in the magnetic stripe located on the back of a plastic badge. The magnetic stripe, sometimes called swipe card or magstripe, is read by swiping past a magnetic reading head. Magnetic stripe cards are commonly used in credit cards, identity cards, and transportation tickets.

A magnetic stripe reader is a device designed to read the information stored within the magnetic stripe of special cards such as credit cards and ATM cards. The magnetic stripe is usually located on the back of the card or badge and contains the account details of the person who owns the card. This information is then verified in real time with the issuer of the card.

Magnetic stripe readers are also known as magstripe readers and credit card readers.

Figure: Magstripe Reader

Punched Card
A punched card (also punch card or punched-card) is a piece of stiff paper that holds digital data represented by the presence or absence of holes in predefined positions. Many early digital computers used punched cards as the primary medium for input of both computer programs and data.

A computer **punched card reader** or just computer card reader is a computer input device used to read computer programs in either source or executable form and data from punched cards. A computer card punch is a computer output device that punches holes in cards. The first punch-card machines appeared over 100 years ago. Punched cards were used as input or output in first generation of computer. Second generation mainframe computer also used punched cards for input and output.

Reading program or data from punched card:
To load the program or read punch card data, each card is inserted in a punch card reader to input data from the card into a computer. As the card is inserted, the punch card reader starts on the top-left side of the card, reading vertically from top to bottom.
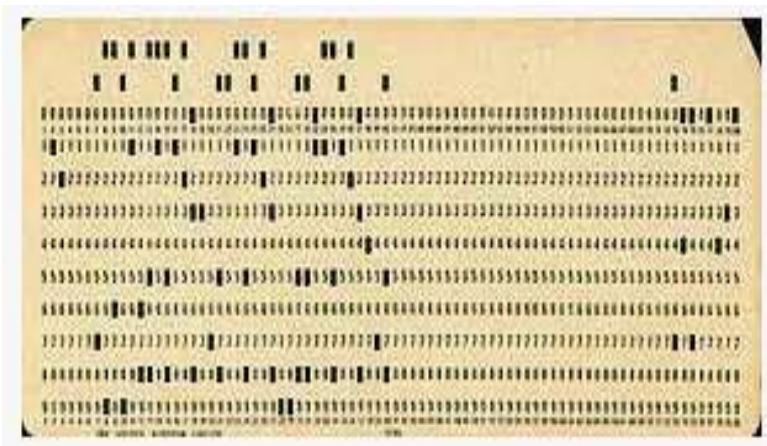

Figure: punched care

Figure: punched care machine

Magnetic and Optical Input Devices:

Optical input devices allow computers to use light as a source of input. **Scanner** is an example of **optical input device**. Other common optical input devices are magnetic ink character reader used for **Magnetic Ink Character Recognition (MICR),** optical mark reader used for **Optical Mark Recognition (OMR),** optical character reader for **Optical Character Recognition (OCR)** and Barcode Reader.

1. **Scanner**
2. **Magnetic Ink Character Recognition (MICR)**
3. **Optical Mark Recognition (OMR)**
4. **Optical Character Recognition (OCR)**

1. **Scanner**

Scanner is an input device that accepts paper document as an input. Scanner is used to input data directly into the computer from the source document without copying and typing the data. The input data to be scanned can be a picture, a text or a mark on a paper. It is an optical input device and uses light as an input source to convert an image into an electronic form that can be stored on the computer. Scanner accepts the source paper document, scans the document and translates it into a bitmap image to be stored on the computer. The denser the bitmap, the higher is the resolution of the image. The quality of scan increases with the increase in resolution. Scanners come with utility software that allow the stored scanned documents to be edited, manipulated and printed.

Figure: Scanner

2. **Optical Character Recognition (OCR)**

OCR is a technique for the scanning of a printed page, translating it, and then using the OCR software to recognize the image as ASCII text that is editable. OCR uses optical character reader for recognition. The optical character reader stores the scanned image as bitmap image which is a grid of dots. Thus, you cannot edit the text that has been scanned. To edit the scanned text, you need OCR software. The OCR software translates the array of dots into text that the computer can interpret as words and letters. To recognize the words and letters of text, the OCR software compares the pattern on the scanned image with the patterns stored inside the computer. The text files generated via OCR can be stored in different formats. Figure below shows the working of the OCR system.
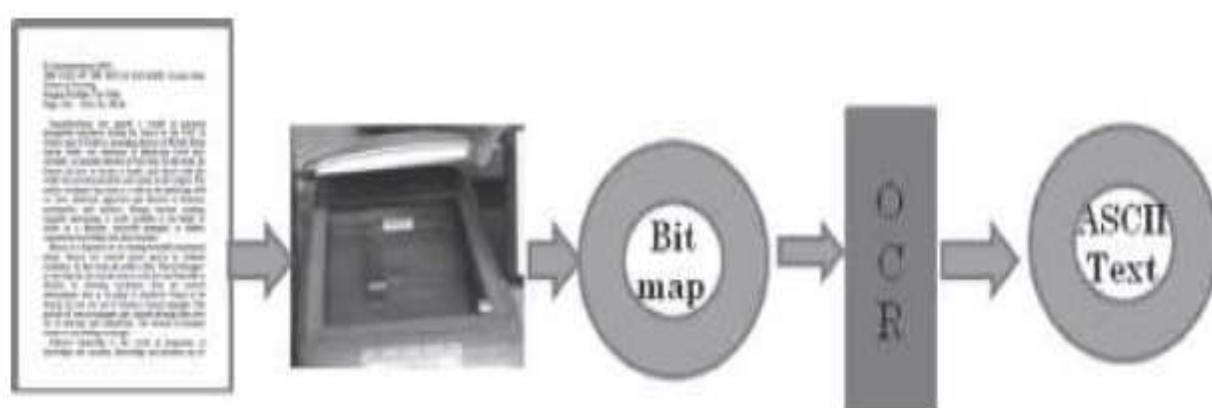

Figure: OCR system

3. **Magnetic Ink Character Recognition (MICR)**

MICR is used in banks to process large volumes of cheques (Figure below). It is used for recognizing the magnetic encoding numbers printed at the bottom of a cheque. The numbers on the cheque are human readable, and are printed using an ink which contains iron particles. These numbers are magnetized. MICR uses magnetic ink character reader for character recognition. When a cheque is passed through Magnetic Ink Character Reader, the magnetic field causes the read head to recognize the characters or numbers of cheque. The readers are generally used in banks to process the cheques. The numbers in the bottom of the cheque include the bank number, branch number and cheque number. The reading speed of MICR is faster than OCR.
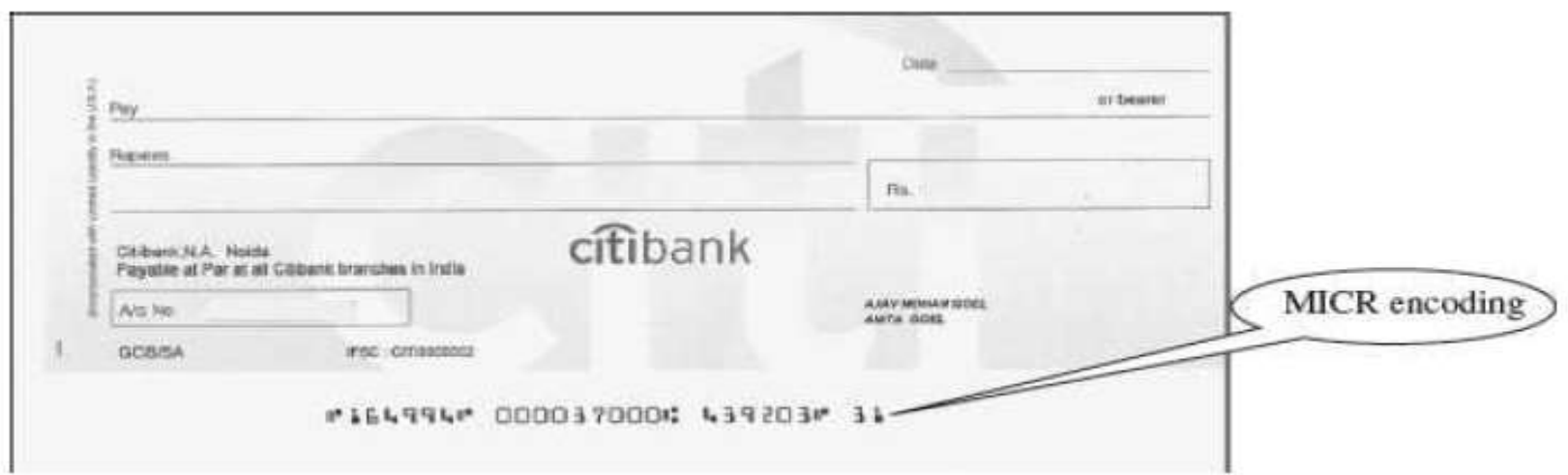
Figure: MICR encoded cheque

4. Optical Mark Recognition (OMR)

OMR is used to detect marks on a paper. The marks are recognized by their darkness. OMR uses an optical mark reader to read the marks. The OMR reader scans the forms, detects the mark that is positioned correctly on the paper and is darker than the surrounding paper, and passes this information to the computer for processing by application software. For this, it uses a beam of light that is reflected on the paper with marks, to capture presence and absence of marks. The optical mark reader detects the presence of mark by measuring the reflected light. The pattern of marks is interpreted and stored in the computer.

OMR is widely used to read answers of objective type tests, where the student marks an answer by darkening a particular circle using a pencil. OMR is also used to read forms, questionnaires, order forms, etc. Figure below shows a marked OMR answer sheet.

Figure: OMR answer sheet

Barcode Reader

Barcodes are adjacent vertical lines of different width that are machine readable. Goods available at supermarkets, books, etc. use barcode for identification. Barcodes are read using reflective light by barcode readers. This information is input to the computer which interprets the code using the spacing and thickness of bars. Hand-held barcode readers are generally used in departmental stores to read the labels, and in libraries to read labels on books. Figure (i) shows a barcode printed at the back of a book. Barcode readers (Figure (ii)) are fast and accurate. They enable faster service to the customer and are also used to determine the items being sold, number of each item sold or to retrieve the price of item.

Figure: (i) Barcode of a book (ii) Barcode reader