

Chapter 4

Input and Output Devices

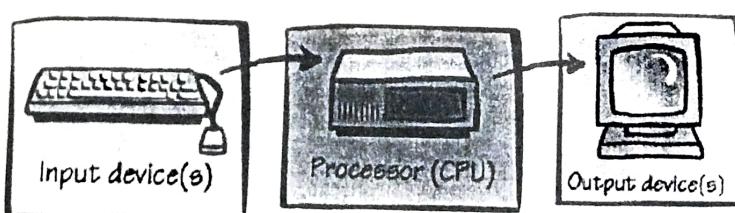
Introduction

This chapter concentrates on the hardware designed for inputting data into the computer, and then outputting results to the user after the data has been processed. In this chapter, the most common input devices used with PCs mainly are discussed. The input devices that are discussed in this chapter are the keyboard, pointing devices (such as a mouse or pen). Next' the devices that are used to capture data in electronic form such as scanners, barcode readers, and digital cameras are explained. Also the input devices for audio data are introduced. The output results are introduced to the user on either the screen or printed on a paper. This chapter discusses the display devices and printers as the main output devices. Also, the output devices for audio output are given.

The objectives of this chapter are:

After completing this chapter, you will be able to:

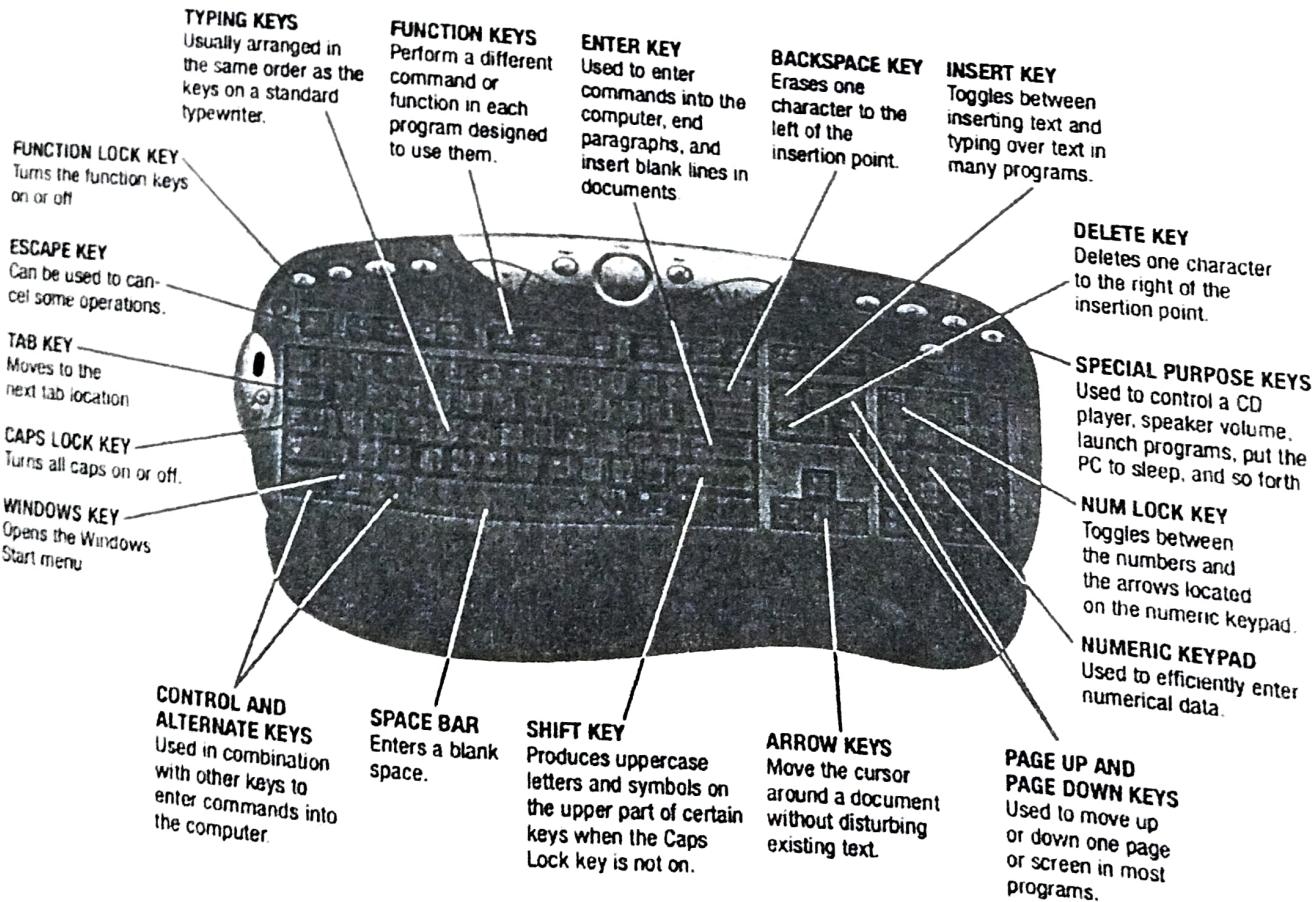
- Explain different types of keyboards and pointing devices.
- Describe the functions of scanners, readers, and digital cameras and explain how they work.
- Understand what audio input is.
- Describe different types of display devices and how they work.
- Explain the main types of printers and how they work.
- Understand what audio output is.



Input Devices:

Keyboards

- Input device containing keys, arranged in a typewriter type of configuration, that can be used to input letters, numbers, and other symbols.
- Most PCs today are designed to be used with a keyboard.
- Contains:
 - Standard alphanumeric keys.
 - Numeric keypad.
 - Function keys.
 - Directional keys and special keys.



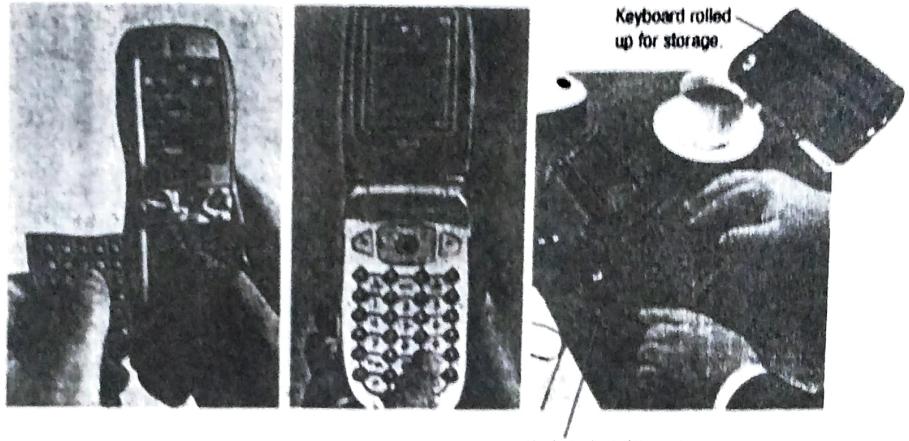
A typical desktop keyboard

Can be:

- Wireless .
- Portable.
- Foldable .
- Handheld PCs and mobile devices today often have a built-in keyboard or *thumb pad* (keyboard designed to be pressed with just the thumbs) .

Date of lecture

Note



FLIP-OPEN THUMB PAD

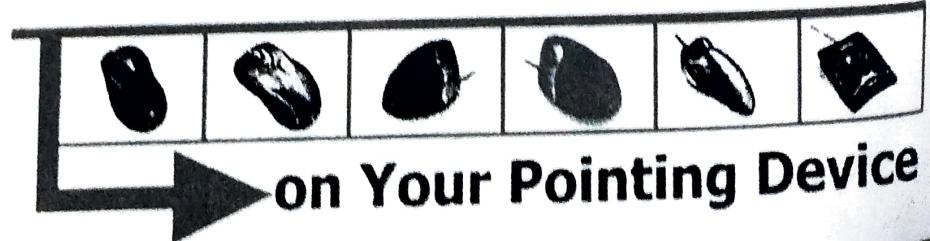
BUILT-IN KEYBOARD

FOLDABLE KEYBOARD

keyboards for handheld PCs and mobile devices

Pointing Devices

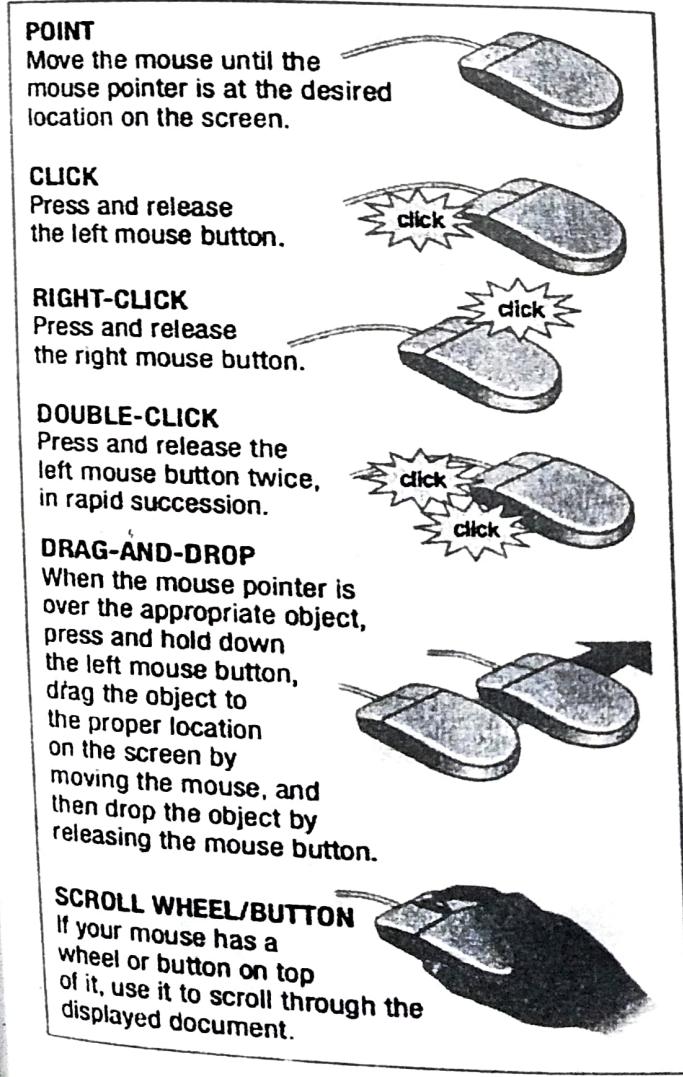
- Pointing device: input device that moves an onscreen pointer (arrow or insertion point) to allow the user to select objects on the screen.
- Usually buttons on the device are used to select objects.
- Common types of pointing devices:
 - *Mouse*.
 - *Electronic pen*.
 - *Touch screen*.



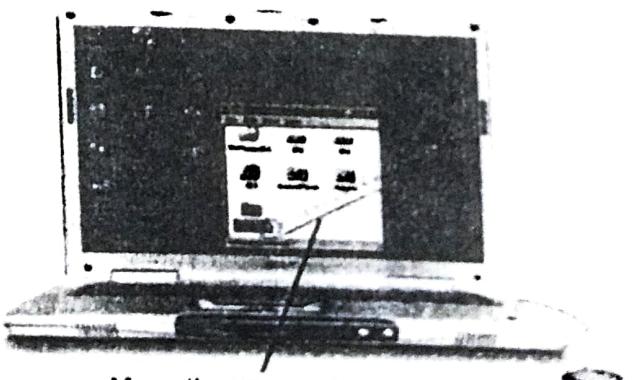
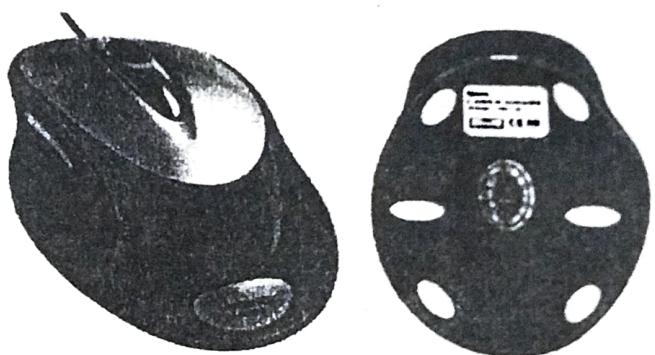
Mouse

Common pointing device that the user slides along a flat surface to move a pointer around the screen and clicks its buttons to make selections.

- Rests on the desk or other flat surface close to the user's PC.
- Older mechanical mice have a ball exposed on the bottom surface.
- Most mice today are optical mice that track movements with light.
- Can be wireless.



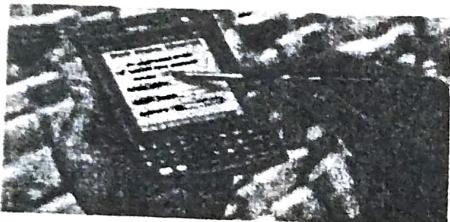
COMMON MOUSE OPERATIONS



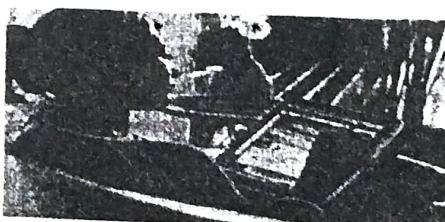
USING A MOUSE

Electronic Pens

- **Electronic pen (stylus or digital pen):**
Used instead of a mouse to select objects, as well as to draw or write electronically on the screen.
- Commonly used with pen-based PCs:
 - To issue commands and input data.
 - If **handwriting recognition** is used, written text can be converted to editable typed text.



HANDHELD PC



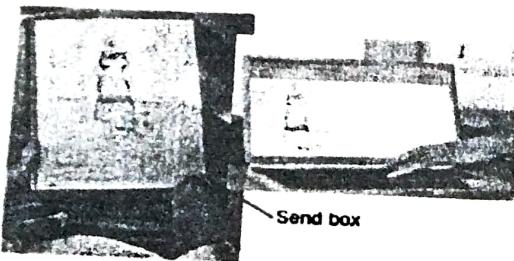
TABLET PC



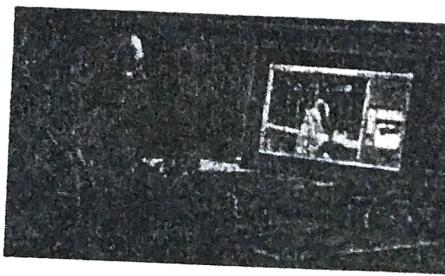
DESKTOP PC

Electronic Pens

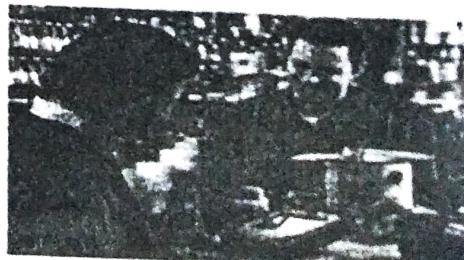
- Also used with:
 - Digital writing systems.
 - Graphics tablets.
 - Signature capture devices.



DIGITAL WRITING SYSTEM
When the Send box on the paper is selected, the document content is transferred wirelessly to the computer.



GRAPHICS TABLET
All input written on the graphics tablet is transferred in real time to the computer.



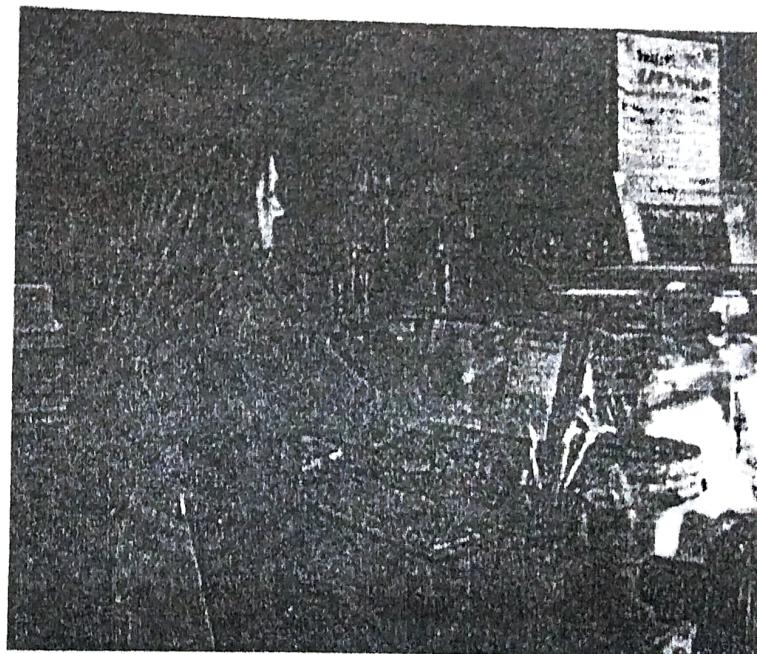
SIGNATURE CAPTURE DEVICE
When a signature is entered and the appropriate confirmation box is tapped, the signature is recorded.

Touch Screens

- **Touch screen:** display device that is touched with the finger to issue commands or otherwise generate input to the connected PC.
- Touch screen kiosks are found in retail stores, movie theaters, courthouses, fast-food restaurants, airports, and point-of-sale (POS) systems.



AIRLINE SELF-CHECK-IN



RESTAURANT ORDER-ENTRY SYSTEM

Other Pointing Devices

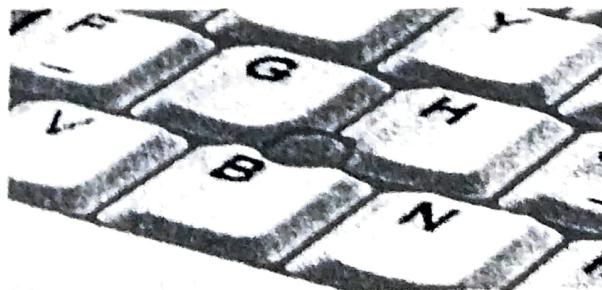
- Joysticks.
- Trackballs.
- Pointing sticks.
- Touch pads.



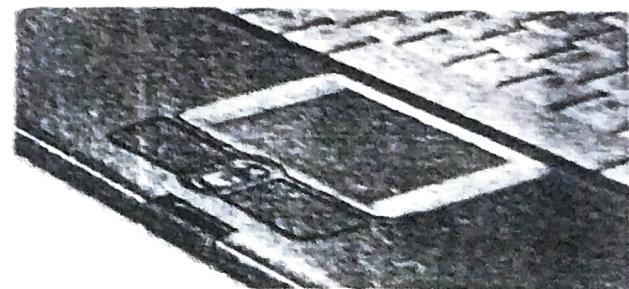
JOYSTICK
Used most often in computer games.



TRACKBALL
Takes up less desk space than a mouse and is easier for some users to manipulate.



POINTING STICK
Found on some notebook PCs. The stick is pushed in different directions to move the onscreen pointer.

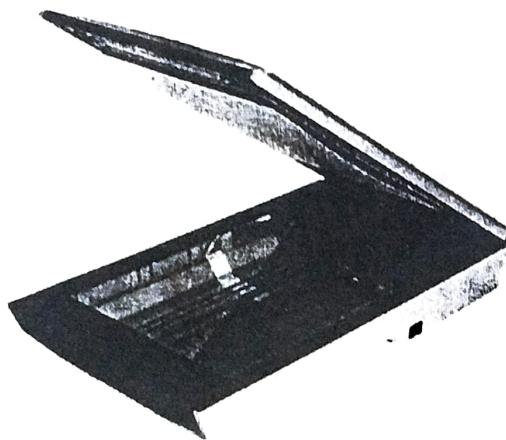


TOUCH PAD
Commonly found on notebook PCs, keyboards, or as a stand-alone device.

Pointing Devices

Scanners, Readers, and Digital Cameras

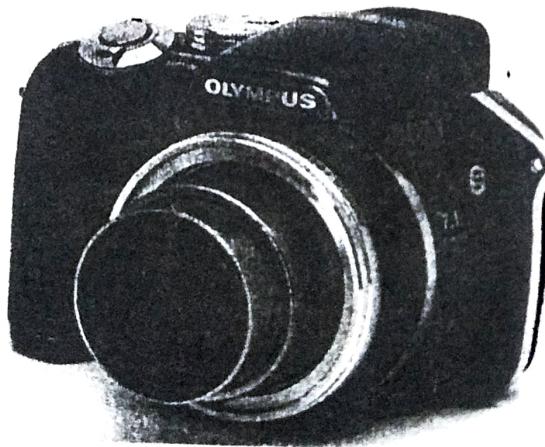
- **Source documents:** documents containing data that already exists in physical form (order form, photograph, invoice, check, or price label).
- **Source data automation:** capturing data directly from a source document.
- Most common devices used in source data automation: scanning or reading devices.



Scanner



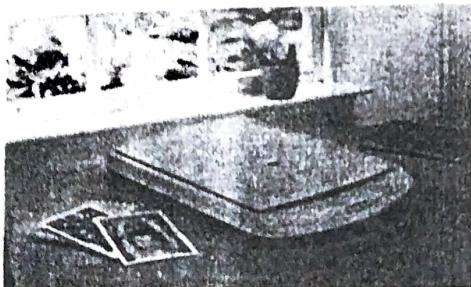
Reader



Digital Camera

Scanners

- Scanner (optical scanner): input device that reads printed text and graphics and transfers them to a computer in digital form.
- Can scan photos, documents, drawings, etc.
- Data is typically input as a single image.
- If optical character recognition (OCR) is used, text is input as editable, typed text.
- **Types of scanners:**
 - Flatbed.
 - Sheetfed.
 - Handheld.
 - Drum.
 - Three-dimensional (3D).
- Quality of scanned images indicated by optical resolution, measured in number of dots per inch (dpi).
- Resolution can often be specified.



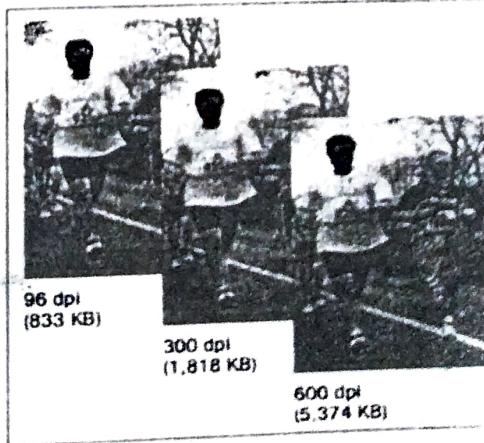
FLATBED SCANNER
Used to input photos, sketches, slides, bound books, and other relatively flat documents into the computer



HANDHELD SCANNER
Used to capture small amounts of text



Sheetfed Scanner
Used to scan one flat document at a time



RESOLUTION
Most scanners let you specify the resolution (in dpi) at which you wish to scan. High-resolution images look sharper but result in larger file sizes.

Readers

- **Barcode readers:** input devices that read barcodes.
- **Barcode:** machine-readable code that represents data as a set of bars.
- **Common types:**
 - Universal Product Code (UPC).
 - Code 39.
 - POSTNET code.

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Note

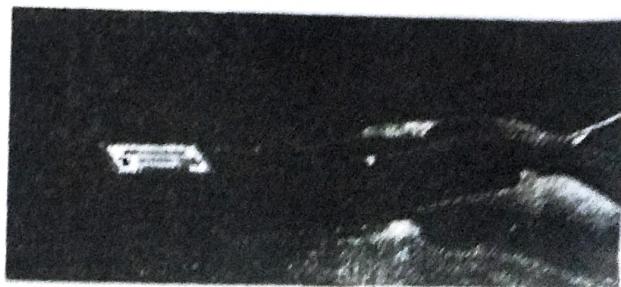


FIXED BARCODE READERS
Used most often in retail point-of-sale applications.



PORTABLE BARCODE READERS
Used when portability is needed.

INTEGRATED BARCODE READERS
Built into or added to
portable PCs



BARCODES
Uniquely identify a product
or service item.



UPC (UNIVERSAL PRODUCT CODE)



CODE 39

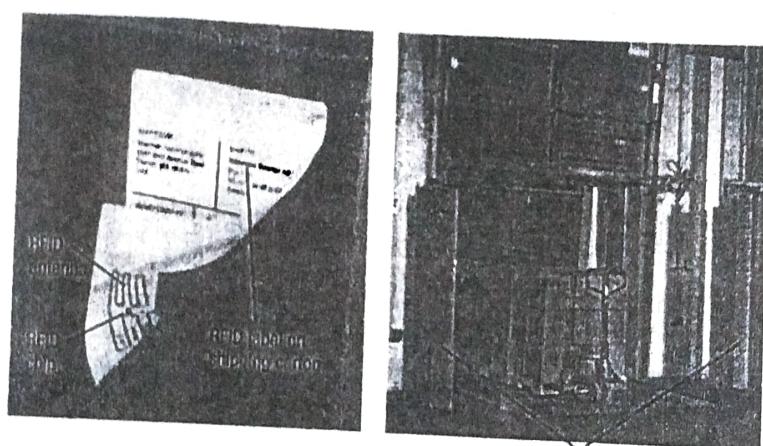
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POSTNET CODE

➤ Radio frequency identification (RFID) readers:

- **Radio frequency identification (RFID):** technology used to store and transmit data located in RFID tags.
- **RFID tag:** device containing tiny chips and radio antennas that is attached to objects that will be identified using RFID technology.
- Applications: tracking inventory pallets and shipping containers, tracking or locating livestock and other animals, tagging tractors and other large assets to keep track of their locations.

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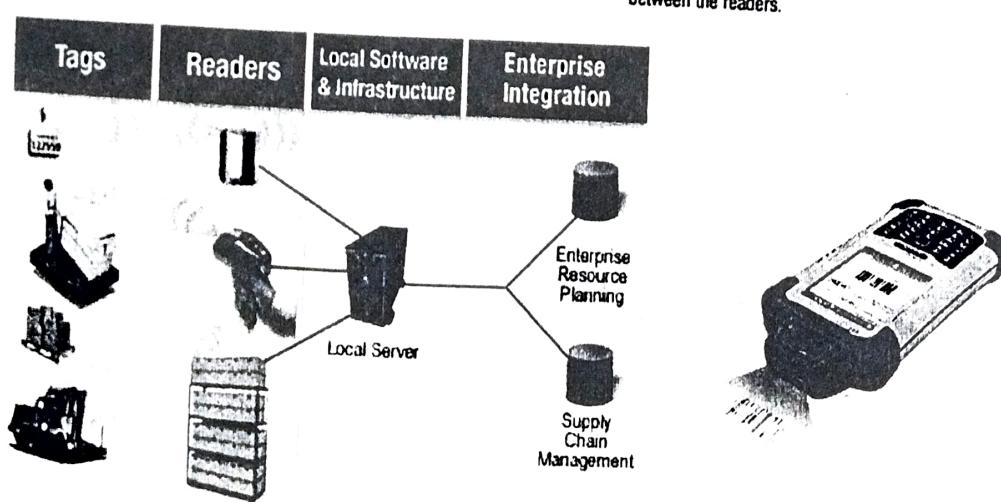


RFID TAGS

RFID tags, containing a built-in chip and an antenna, are often included in shipping labels today.

RFID READERS

This portal RFID reader reads all of the RFID tags on a palette at one time, as it passes between the readers.



Note:

SOURCE: ida.gov.sg

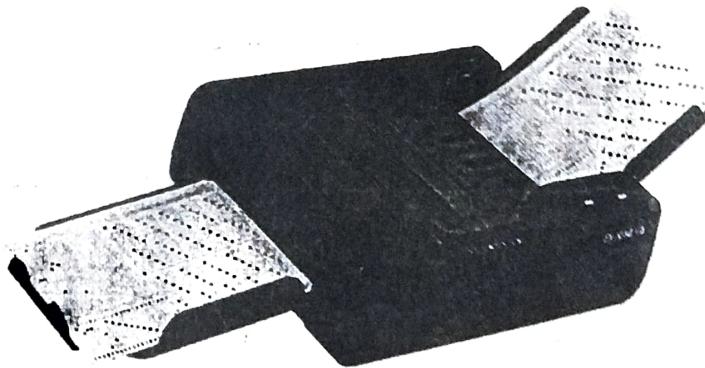
RFID

➤ Optical mark readers (OMRs):

Input data from special forms to score or tally exams, questionnaires, ballots, and so forth.

- Use pencil to fill in small circles/shapes on the form to indicate their selections.
- Forms are inserted into an optical mark reader to be scored or tallied.

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Optical mark reader

➤ Optical character recognition (OCR) devices:

Read optical characters.

- *Optical characters* are designed to be identifiable by humans as well as OCR device.
- Widely used in turnaround documents, such as monthly bills

PLEASE RETURN THIS PORTION WITH PAYMENT		MAKE CHECKS PAYABLE TO SIERRA PACIFIC POWER COMPANY	
 Sierra Pacific™		ACCOUNT NUMBER 10 000012567 01320001 0 <small>Customer No. Payment No.</small>	
Service Address: 4041 MC CARRAN ST RENO NV 89502-1234		BALANCE FORWARD 00 CURRENT CHARGES 110.10 TOTAL AMOUNT DUE \$110.10 <small>Total amount due on or before Apr 8, 2007</small>	
Please enter amount paid below \$ _____ 00520-0400			
MARY PERSON 4041 MC CARRAN ST RENO NV 89502-1234			
1000001256701335519 000011010 0 007			

OPTICAL CHARACTERS

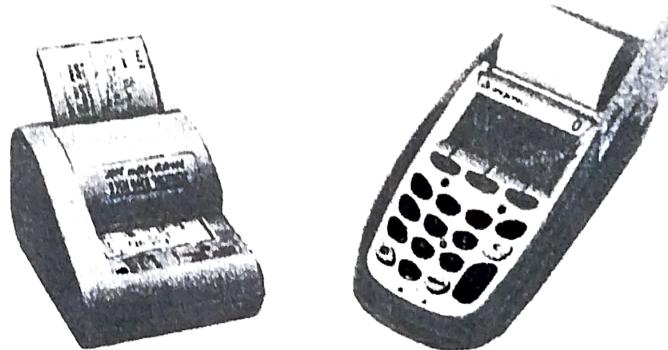
These OCR characters indicate the customer account number and amount due and can be read by both computers and humans.

Optical characters

➤ Magnetic ink character recognition (MICR) readers:

Read MICR characters.

- Used primarily for banking
- MICR readers read the special magnetic characters.
- and sort/process.
- checks.

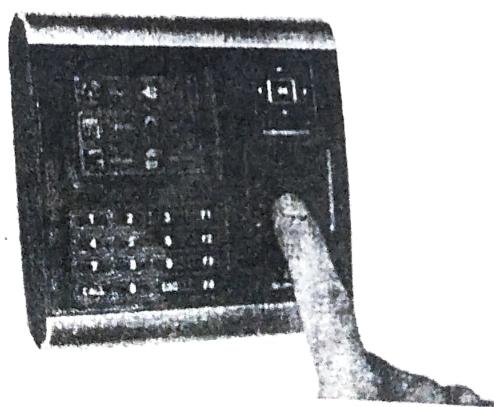


Magnetic ink character recognition (MICR) readers

➤ Biometric readers:

Used to input biometric data.

- **Biometric data** is based on unique physiological characteristics (fingerprint, hand geometry, face, iris of the eye) or personal traits (voice, signature).
- Readers can be stand-alone or built into another piece of hardware (keyboard, mouse).
- Also being built into computers and storage devices to allow access only by authorized individuals.
- Most often used for access control and to verify transactions.



Biometric readers

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Note

Digital Cameras

Input device that takes pictures and records them as digital data (instead of film or videotaped) images.

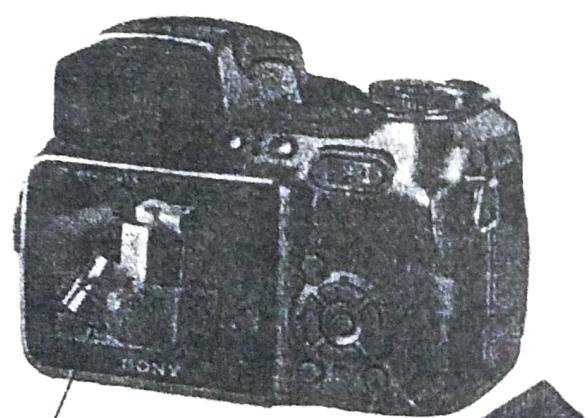
- Usually designated as:
 - **Still cameras** (take individual still photos).
 - **Video cameras** (capture moving video images).

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Note:

➤ Digital still cameras:

- Available in a wide variety of sizes and capabilities.
- Images are immediately available for viewing or printing.
- Typically use flash memory for storage.
- Photos can be transferred to a PC or printer.
- Digital photos can be retouched with image editing software, posted to a Web page, or burned onto a CD or DVD disc.
- Camera quality is measured in megapixels.



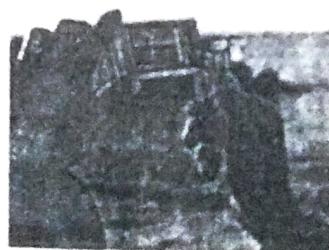
PREVIEWS
Virtually all digital cameras let you display and erase images while shooting.

TYPICAL CONSUMER DIGITAL CAMERA



PROFESSIONAL DIGITAL CAMERA

STORAGE MEDIA
Some cameras use removable storage media in addition to, or instead of, built-in storage.

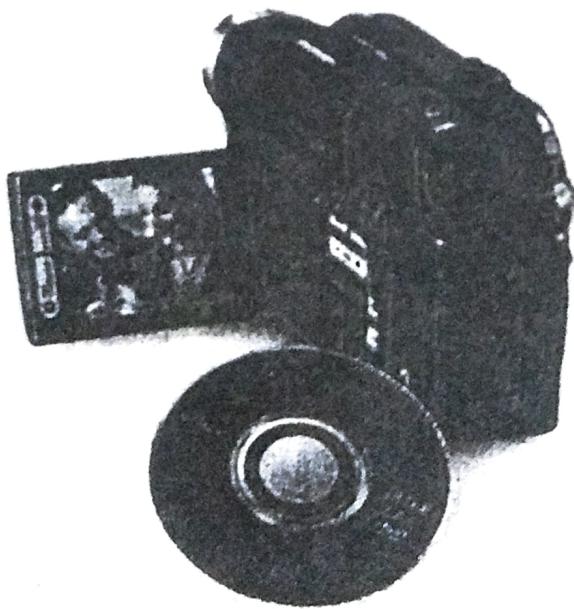


DIGITAL CAMERA INTEGRATED INTO A MOBILE PHONE

➤ Digital video cameras:

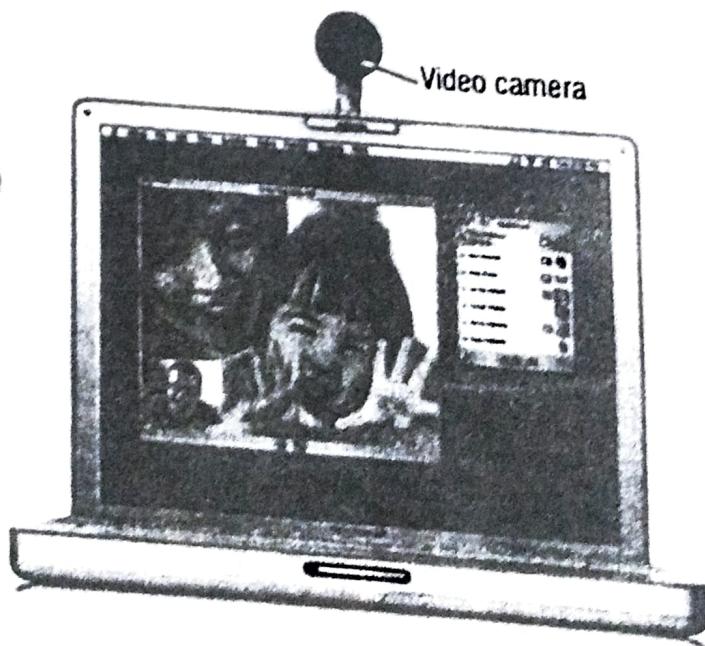
Include digital camcorders and small PC video cameras:

- **Digital camcorders:** similar to analog camcorders, but they store images on digital media—typically either on mini digital video (DV) tape cartridges or rewritable DVDs.
- **PC video cameras (PC cams, Web cam):** designed to transmit video images over the Internet, such as during a videoconference or video phone call.



DIGITAL CAMCORDER

Typically allows you to view video during and after it is recorded; digital media, such as the DVD shown here, are used for storage instead of videotape.



PC VIDEO CAMERA

Commonly used to deliver video over the Internet, such as in the family videoconference shown here.

Digital video cameras

Audio Input :

Process of entering audio data into the computer (voice and music).

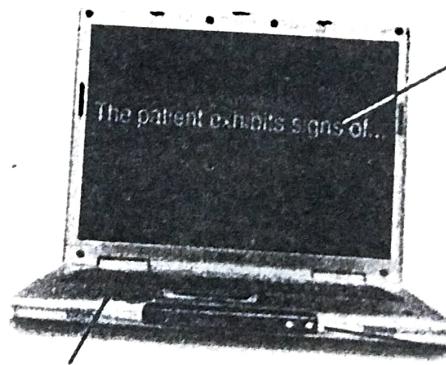
- **Voice input systems (speech recognition systems):** enable a computer to recognize the human voice.
 - Consist of a microphone or headset and appropriate software.
 - Can be used to dictate text or commands into a PC.
- Ocompositions or via a CD or DVD player).

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Note:



1. The user speaks into a microphone that cancels out background noise and inputs the speech into the computer.



2. An analog-to-digital converter on the sound card located inside the PC converts the spoken words to phonemes, the fundamental sounds in the language being used, and digitizes them.

4. The spoken words appear on the screen in the application program (such as a word processor or an e-mail program) being used.

3. Voice recognition software matches up the phoneme combinations to determine the words that were spoken. Sentence structure rules are used to select one word if it is a questionable match or a word with

Speech recognition systems

Output device :

Display Devices

Output device that presents output visually.

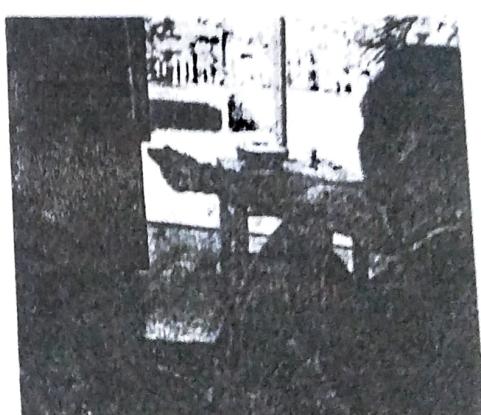
- **Soft copy:** output that appears on a display device.
- **Monitor:** display device for a desktop PC.
- **Display screen:** screen built into the unit of all-in-one PCs, notebook computers, handheld PCs, smart phones, consumer devices, and many other devices.



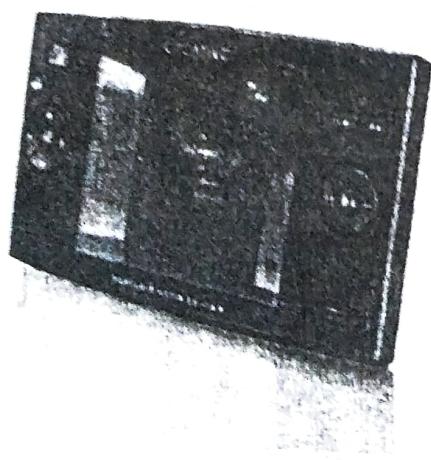
COMPUTERS



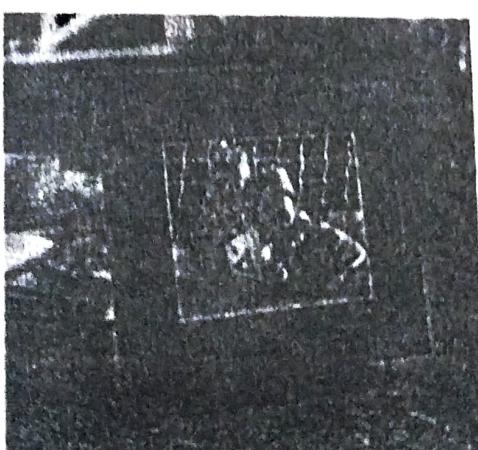
SMART PHONES



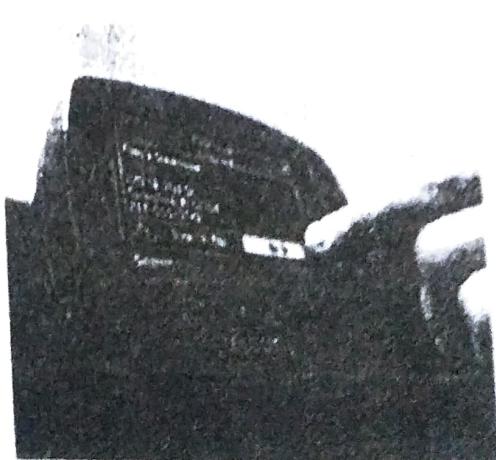
HOME ELECTRONICS



PORTABLE MEDIA PLAYERS



DIGITAL PICTURE FRAMES



CAR NAVIGATION SYSTEMS

Display Device Characteristics

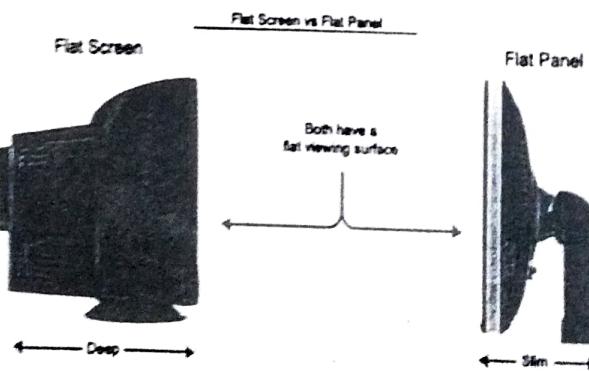
- Usually color, but can be monochrome.
- Can be a CRT monitor or a flat-panel display.
 - **CRT monitor:** projects images onto a display screen using technology similar to that of TVs.
 - **Flat-panel display:** forms images by manipulating electronically charged chemicals or gases sandwiched between thin panes of glass.

➤ CRT vs. Flat-Panel Monitors:

CRT monitors are based on using the cathode ray tube technology used in conventional TVs. In this technology, an electron gun sealed inside a large glass tube projects an electron beam at a screen coated with red, green and blue phosphor dots. This beam lights up the appropriate colors in each pixel to display the necessary image. The CRT is:

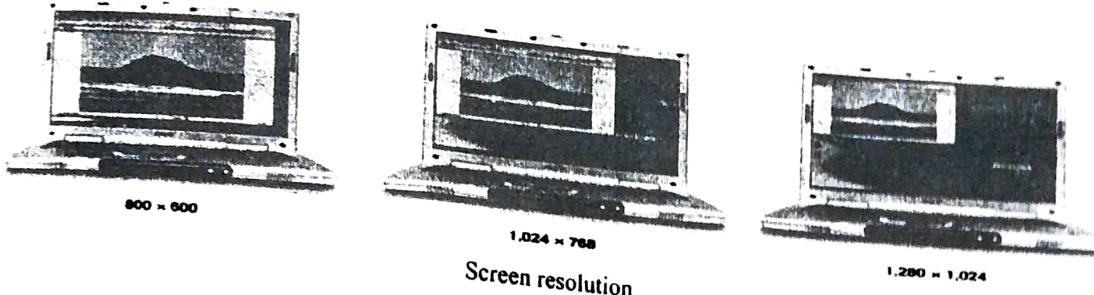
- Large.
- Bulky.
- Heavy.
- Consuming high power.

Although CRTs are still in use, most today's computers use flat-panel displays. Both CRT and flat-panel monitors are shown in the following illustrative Figure.

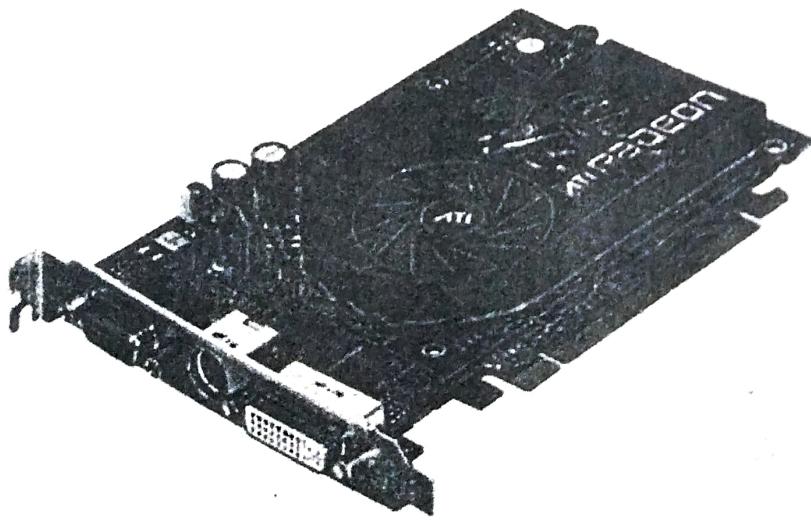


The main features of a display unit are:

- Size (measured diagonally).
- Screen resolution .
 - Can be changed.
 - Higher resolution = more data on the screen at one time.



- Video card (determines display characteristics and how monitor can connect to the PC).
- Monitors can be also be:
 - Wired or wireless.
 - 2D or 3D Displays.
 - Digital TV and/or HDTV (High Definition TV) ready or capable.



Video card

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Note

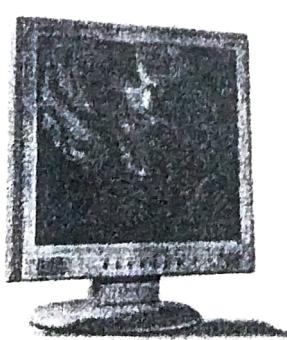
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➤ Flat-Panel Display Technologies:

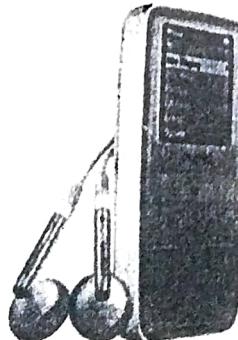
Flat-panel displays depend on using electronically charged chemicals or gases sandwiched between thin panes of glass or other transparent material. They need less space and consume less power than CRTs. Also, they depend on digital signals rather than analog signals used by CRT which produces sharper images.

One disadvantage of flat-panel displays is the displayed images sometimes cannot be seen clearly when viewed from certain angles. Among the types of flat-panel displays are:

- **Liquid crystal displays (LCDs):**
Use charged liquid crystals to display images.
- **Organic light emitting diode (OLED) displays:**
Use emissive organic material to display brighter and sharper images.
 - Flexible OLEDs (FOLEDs).
 - Transparent OLEDs (TOLEDs).
 - Phosphorescent OLEDs (PHOLEDs).
- **Plasma displays:**
Use layers of gas to display images; most often used on large displays.



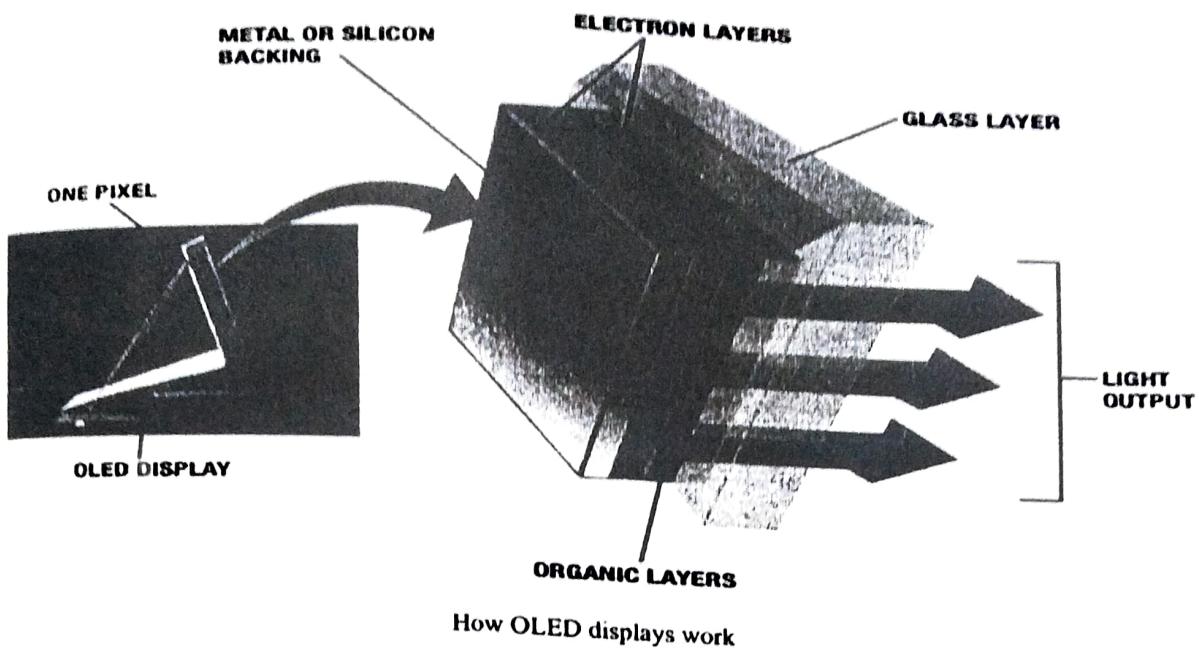
LCD DISPLAYS
The most common type of computer monitor and flat-panel television.



OLED DISPLAYS
Used primarily with smaller displays, like digital cameras and handheld PCs.



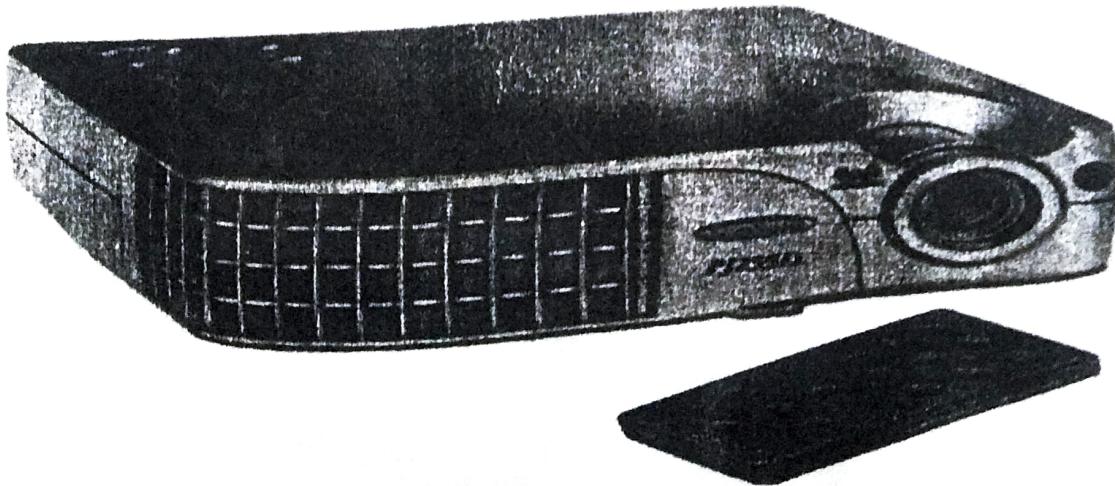
PLASMA DISPLAYS
Used primarily with large computer monitors and TVs.



How OLED displays work

Data and Multimedia Projectors

- Data projector: display device that projects all computer output to a wall or projection screen.
- Most data projectors today can project video, in addition to computer output.
- Can be wireless projectors.



Projectors

Note:

Printers

Output device that produces output on paper.

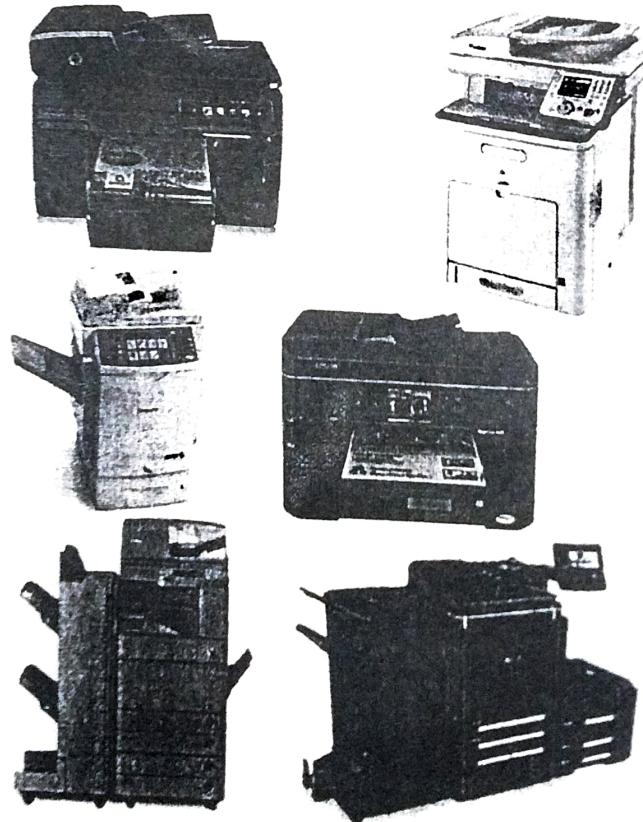
- Produce hard copy.
- Can be used with both desktop and portable PCs.

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Note:

Printer characteristics

- Impact vs. nonimpact printing.
 - Most printers are nonimpact.
 - Impact printers (like dot-matrix printers) are still used for printing multipart forms and shipping documents.
- Can print in color or black-and white only.
- Can be a personal or network printer.
- Quality is called print resolution and measured in dots per inch (dpi).
- Print speed is measured in pages per minute (ppm).

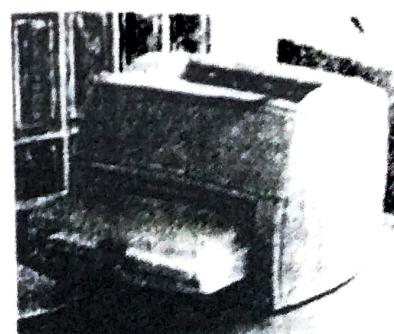
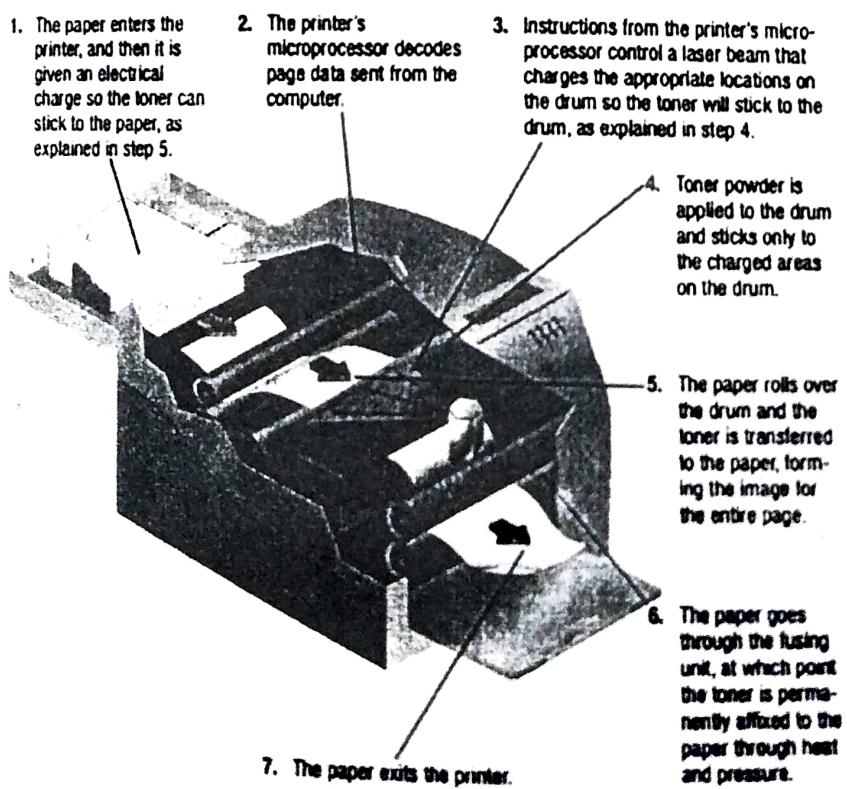


Printers

➤ Laser Printers:

Laser printer is an Output device that uses toner powder and technology similar to that of a photocopier to produce images on paper. The following Figure illustrates the steps of printing on a black-and-white laser printer. The characteristics of the laser printer are:

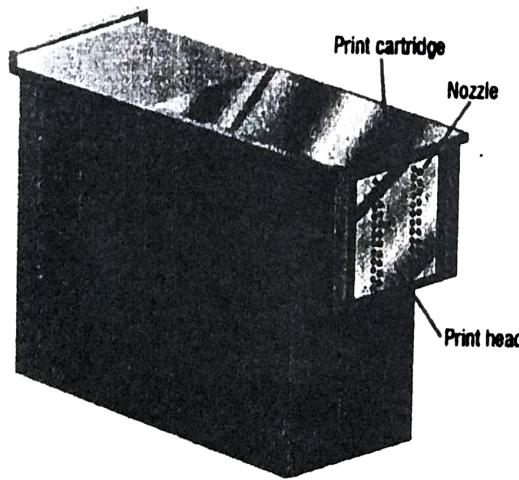
- The standard for business documents.
- Print one entire page at a time.
- Usually black and white, though color printers are available.
- Common print resolution for laser printers is between 600 and 2,400 dpi.



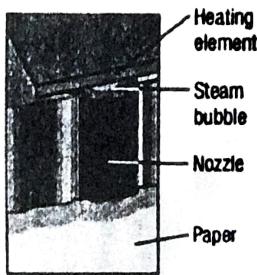
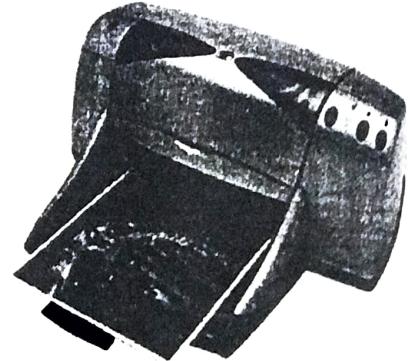
➤ Ink-Jet Printers:

Ink-jet printer is an output device that sprays droplets of ink to produce images on paper as shown in the following Figure. The main characteristics of the ink-jet printers are:

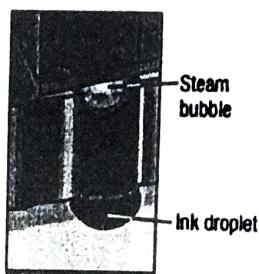
- Typically print in color.
- Often the choice for home use.
- Print fairly slowly, one line at a time.
- Quality not quite as good as a laser printer.



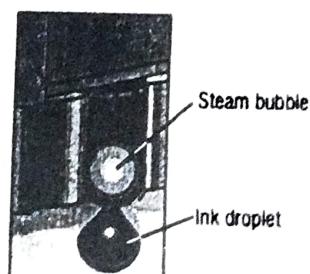
HOW INK-JET PRINTERS WORK
Color ink-jet printers create colors by mixing different combinations of four colors of ink—magenta, cyan, yellow, and black. The different colors can be in one or multiple cartridges. Each cartridge is made up of 300 or more tiny ink-filled firing chambers, each attached to a nozzle smaller than a human hair. To print images, the appropriate color ink is ejected through the appropriate nozzle.



1. A heating element makes the ink boil, which causes a steam bubble to form.



2. As the bubble expands, it pushes ink through the nozzle.



3. The pressure of the bubble forces an ink droplet to be ejected onto the paper. When the steam bubble collapses, more ink is pulled into the print head, so it is ready for the next steam bubble.

➤ Special Purpose Printers:

- **Photo printers** (designed to print photographs).
- **Barcode printers** (print barcodes; some can encode RFID tags).
- **Label printers** (print labels, electronic postage, etc.).
- **Portable printers** (designed to be carried with you).
- **Plotters and wide-format ink-jet printers** (print on large paper or other large materials).

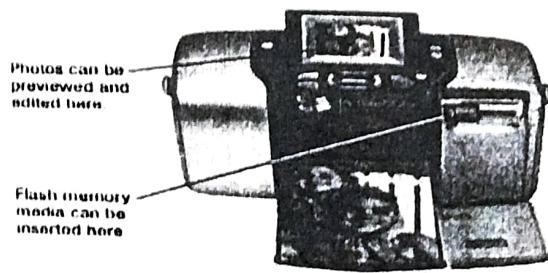
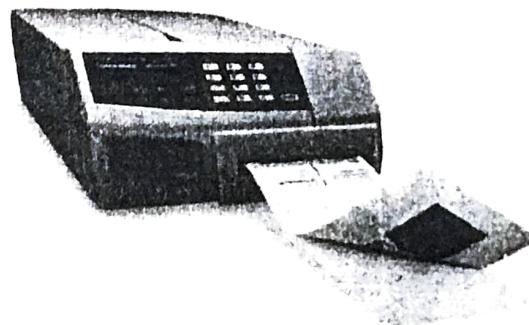
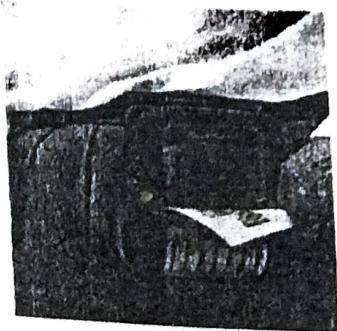


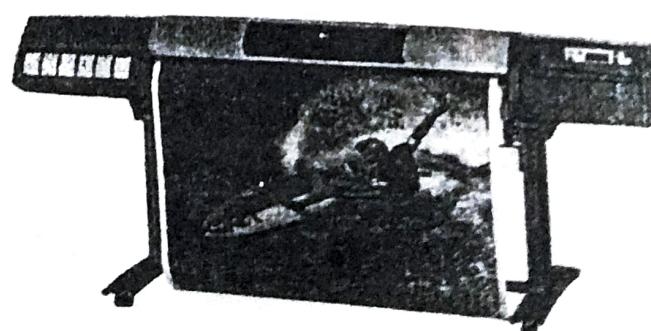
PHOTO PRINTERS
Used to print digital photographs, such as those taken with a digital camera.



BARCODE PRINTERS
Used to print barcoded labels. This printer can also program RFID tags, when they are embedded inside the barcoded labels.



PORABLE PRINTERS
Used to print from a portable PC or while on the go.



WIDE-FORMAT PRINTERS
Used for printouts that are too big for a standard-sized printer.

Multifunction Devices

➤ Audio Output:

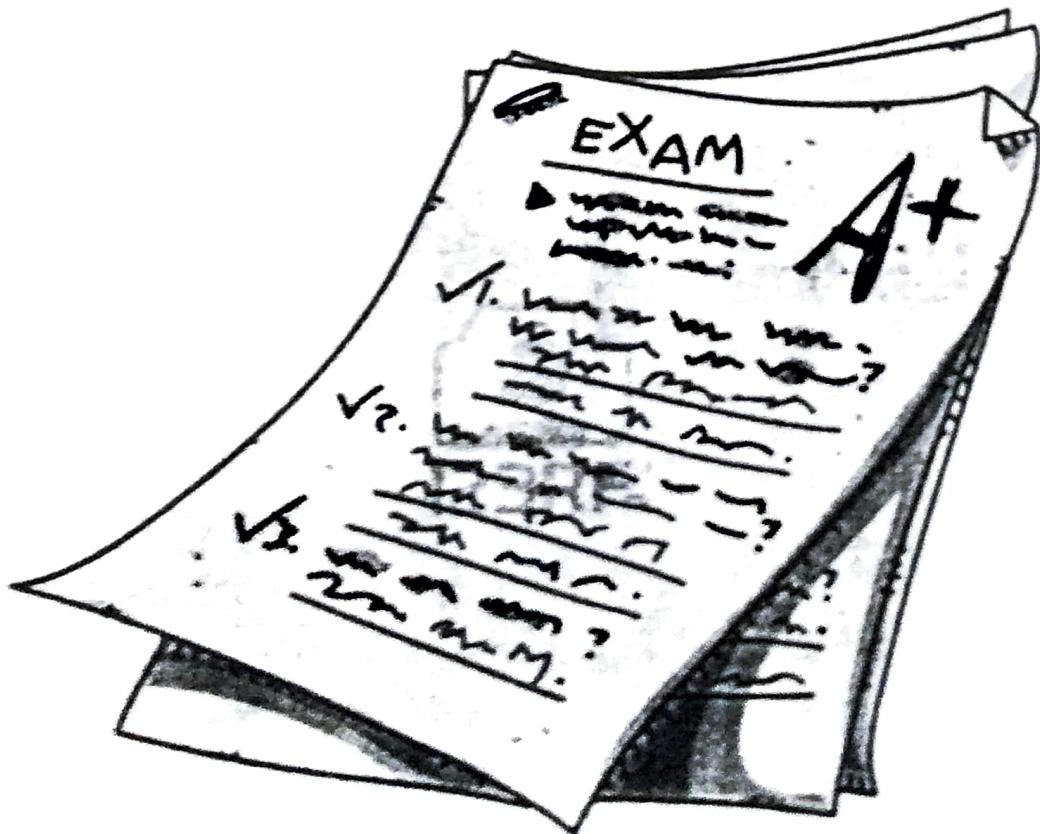
- **Audio output:**

Output in the form of voice or music.

- **Speakers:** connect to a PC and provide audio output for computer games, music, video, TV, videoconferencing, and other applications that have audio output.
- **Voice output systems:** produce spoken output.



Exercises



1- Match each key term on the left with the definition on the right that best describes it.

Date _____

2-

3-

Key term matching	Description
a. digital camera	1- A common pointing device that the user slides along a flat surface to move a pointer around the screen and clicks its buttons to make selections.
b. ink-jet printer	2- A device containing a tiny chip and a radio antenna that is attached to an object so it can be identified using radio frequency identification technology.
c. laser printer	3- A display device that is touched with the finger to issue commands or otherwise provides input to the connected device.
d. mouse	4- An input device that reads printed text and graphics and transfers them to a computer in digital form.
e. OLED display	5- An input device that is used to write electronically on the display screen.
f. optical character recognition (OCR)	6- An input device that takes pictures and records them as digital images.
g. RFID tag	7- An output device that uses toner powder and technology similar to that of a photocopier to produce images on paper.
h. scanner	8- A type of flat-panel display that uses emissive organic material to display brighter and sharper images.
i. stylus	9- An output device that sprays droplets of ink to produce images on paper.
j. touch screen	10- The ability of a scanning device to recognize scanned text characters and converts them to electronic form as text, not images.

2- Circle T if the statement is true, F if the statement is false.

- a). T F A keyboard is an example of a pointing device.
- b). T F Most digital still cameras store photos on flash memory media.
- c). T F UPC is a type of barcode.
- d). T F Consumer kiosks located in retail stores commonly use touch screens for input.
- e). T F An ink-jet printer normally produces a better image than a laser printer.

Date
/ / 20**3- Write the best answer in the space provided.**

- a). With..... software, pen-based computers can convert handwritten text into editable, typed text.
- b). A(n) can be used to convert flat printed documents, such as a drawing or photograph, into digital form.
- c). The smallest colorable area in an electronic image (such as a scanned document, digital photograph, or image displayed on a display screen) is called a(n)
- d). Portable computers and mobile devices virtually always use displays, while some desktop computers may use the larger, more bulky monitors.