Chapter 04 - Input and Output

GE-161 Introduction to Information and Communication Technologies

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Learning Objectives

1. Explain the purpose of a computer keyboard and the types of keyboards widely used today.
2. List several different pointing devices and describe their functions.
3. Describe the purposes of scanners and readers and list some types of scanners and readers in use today.
4. Explain what digital cameras are and how they are used today.
5. Understand the devices that can be used for audio input.
6. Describe the characteristics of a display device and explain some of the technologies used to display images.
7. List several types of printers and explain their function.
8. Identify the hardware devices typically used for audio output.

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Overview

- This chapter covers:
  - Different types of keyboards and pointing devices
  - Types of scanners, readers, and digital cameras
  - Audio input devices
  - Types of display devices and how they work
  - Types of printers and how they work
  - Audio output

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Keyboards

- Keyboard: An input device used to enter characters at the location marked by the insertion point or cursor
  - Can be wired or wireless
- Most computers today are designed to be used with a keyboard
- Typically contains:
  - Standard alphanumeric keys
  - Numeric keypad
  - Function keys
  - Delete and Backspace keys
  - Control and Alternate keys
  - Arrow directional keys and special keys

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Keyboards

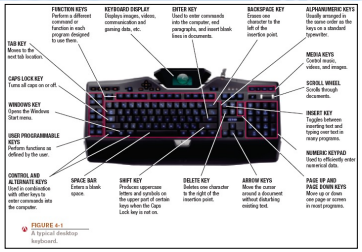

FIGURE 4-1 A typical desktop keyboard.

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Keyboards

- Portable computers and mobile devices often use:
  - Built in or slide-out keyboard
  - Pen or touch input (on-screen keyboard)
  - Voice input

FIGURE 4-2 Keyboards for mobile devices.

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Pointing Devices

- Pointing devices: Used to select and manipulate objects
  - Used to input data
  - Used to issue commands to the computer
- Common types of pointing devices:
  - Mouse
  - Pen/stylus
  - Touch screen

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Mice

- Mouse: 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
  - Older mechanical mice use a ball
  - Optical or laser mice track with light
  - 3D mice
  - Can be wireless

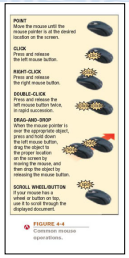

FIGURE 4-4 Common mouse operations.

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Pens/Styluses

- Stylus: Pen-like device used to draw or write electronically on the screen
- Also called digital pen, electronic pen, tablet pen
- Commonly used with pen-based computers
  - Used to issue commands and input data
  - If handwriting recognition is used, written text can be converted to editable typed text

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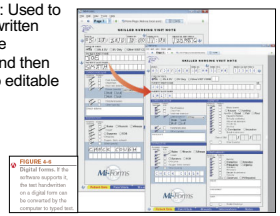
Handwriting Recognition

- Digital form: Used to input handwritten data into the computer and then convert it to editable text



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Pens/Styluses

- Other uses for pens/styluses:
  - Digital writing systems
  - Graphics tablets
  - Signature capture devices

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Touch Screens

- Touch screen: Display device that is touched with the finger to select commands or otherwise provide input to the computer
- Used with:
  - Desktop and portable computers
  - Mobile phones and mobile devices
  - Surface computing
  - Consumer kiosks
- Can be multi-touch

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Touch Screens

FIGURE 4-8 Touch screens.

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Other Pointing Devices

- Other pointing devices:
  - Joysticks, gamepads, and other gaming devices
  - Trackballs
  - Buttons and wheels
  - Touch pads

FIGURE 4-9 Other common pointing devices.

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Quick Quiz

1. An optical mouse is _____.
   a. the same as a wireless mouse
   b. a mouse that tracks movements with light instead of a ball
   c. a mouse that contains a scroll wheel on the top
2. True or False: With handwriting recognition, text is input as a graphical image so the text cannot later be edited as text.
3. An input device that looks like an upside-down mouse with the ball on top is a(n) _____.

Answers:
1) b; 2) False; 3) trackball

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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
  - Saves time
  - Increases accuracy
  - Scanning or reading devices

FIGURE 4-10 Source data automation. Recording data initially in digital form or capturing data directly from the source document helps reduce data input errors and save time.

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Scanners

- Scanner (optical scanner): Input device that captures an image of an object and transfers them to a computer in digital form
  - Can scan photos, documents, drawings, (flat objects)
  - Data is typically input as a single image
  - If optical character recognition (OCR) is used, text is input as individual text characters
- Types of scanners
  - Flatbed
  - Portable
  - 3D
  - Integrated (ATMs, etc.)

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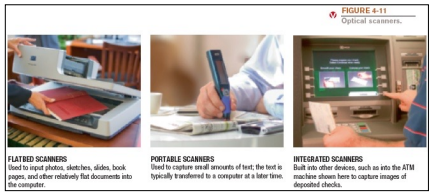
Scanners



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Scanners

- Optical resolution: Quality of scanned images
  - Measured in number of dots per inch (dpi)
  - Can often be specified when image is scanned
  - Can be changed when scanned image is edited
  - Varies with scanner used
  - Higher resolution = better quality but larger file size

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Barcode 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)
    - ISBN
    - Code 39
    - Intelligent mail code
    - 2D (QR) – hold more data

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Barcode Readers

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Radio Frequency Identification (RFID) Readers

- Radio frequency identification (RFID): Technology used to store and transmit data located in RFID tags
- RFID tag: Contains tiny chips and radio antennas
  - Attached to objects for identification purposes
  - Read by RFID readers
  - Tags only need to be within range of the reader, rather than in the line of sight
- Applications
  - Tracking inventory and assets
  - Electronic tolls
  - Tracking patients in hospitals
  - Ticketing applications
  - Security: Speeding up ID process

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Radio Frequency Identification Readers

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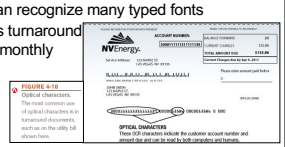
Optical Mark Readers (OMRs) and Optical Character Recognition (OCR) Devices

- Optical mark readers (OMRs): Input data from special forms to score or tally exams, questionnaires, ballots
- Optical character recognition (OCR): The ability of a computer to recognize scanned text characters and convert them to electronic form as text, not images
  - OCR readers can recognize many typed fonts
  - Used to process turnaround documents like monthly bills



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Magnetic Ink Character Recognition (MICR) Readers

- Magnetic ink character recognition (MICR) readers: Read MICR characters
  - Used primarily for banking
  - MICR readers read the special magnetic characters and sort/process checks
  - Can be used for remote deposit

FIGURE 4-19
Magnetic ink character recognition (MICR) readers are used primarily to process checks.

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Biometric Readers

- Biometric data: Based on unique physiological characteristics or personal trait
  - Fingerprint
  - Hand or face geometry
  - Iris of the eye
  - Voice or signature
- Biometric readers: Used to input biometric data
  - Can be stand-alone or built into another piece of hardware
  - Used to allow access only by authorized individuals
  - Most often used for access control and to verify transactions

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Biometric Readers

STAND-ALONE FINGERPRINT READERS
Often used to control access to facilities or computer systems, such as to the notebook computer shown here.

BUILT-IN FINGERPRINT READERS
Typically used to control access to the device into which the reader is built, such as to the external hard drive shown here.

FIGURE 4-20
Biometric readers.

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Digital Cameras

- Digital cameras: Record images on digital storage medium rather than film
  - Can either be still cameras or video cameras
  - Integrated into many portable computers and mobile phones.
- Digital still cameras
  - Available in a wide variety of sizes and capabilities
  - Primary appeal is images immediately available
  - Camera quality is measured in megapixels
  - Typically use flash memory for storage
  - Camera phones can be used to read barcodes, for mobile deposit, etc.

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Digital Still Cameras

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Digital Cameras

- Digital video cameras
  - Digital camcorders
  - PC video cameras (PC cams, Web cam)
  - Store images on digital media (flash memory, DVDs, hard drives, etc.)
- Applications:
  - Surveillance video cameras
  - Video conferences and Webinars
  - Face recognition systems

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Audio Input

- Audio input: The process of entering audio data into the computer
- Voice input: Inputting spoken words and converting them to digital form
  - Via microphone or headset
  - Recorded for narrations, podcasts, etc.
  - VoIP (Voice over IP systems) applications
  - To provide spoken instructions to computer (speech recognition systems)
- Music input systems are used to input music
  - Microphones, keyboard controllers, etc.

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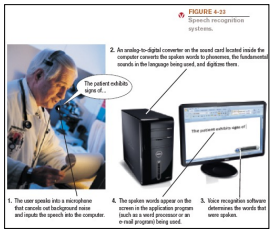
Voice Input Systems



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Quick Quiz

1. Which of the following is used in conjunction with Scantron test forms, voting ballots, and other documents in which the selection is bubbled in?
   a. OCR
   b. MICR
   c. OMR
2. True or False: Flatbed scanners can be used to scan photos, as well as documents on conventional paper.
3. A voice input system requires software and a(n) _____ in order to input voice data or commands into a computer.

Answers:
1) c; 2) True; 3) microphone

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Display Devices

- Display device: Presents output visually
  - Monitor: Display device for a desktop computer
  - Display screen: Screen built into a variety of devices
    - Notebook and other portable computers
    - Mobile phones and mobile devices
    - Handheld gaming devices, home entertainment devices, kitchen appliances
    - Digital photo frames, e-book readers
    - Digital signage systems, digital billboards

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Display Devices

FIGURE 4-35 Uses for display devices.

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Display Device Characteristics

- Color vs. monochrome
- CRT vs. flat-panel displays
- Size and aspect ratio
- Screen resolution
- Video adapters, interfaces, and ports
- Wired vs. wireless displays
- 2D vs. 3D
- Touch and gesture capabilities

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Video Adapters

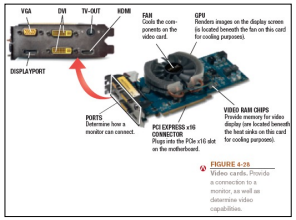

FIGURE 4-28 Video cards. Provide a connection to a monitor, as well as determine video capabilities.

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Flat-Panel Display Technologies

- Liquid crystal displays (LCDs): Use charged liquid crystals between sheets of glass or plastic
  - Requires backlighting
- LED (Light emitting diode): Used in displays as well as a variety of consumer products
- OLED (Organic Light emitting diode) – Uses layers of organic material
  - Emit visible light when current is applied
  - FOLED (Flexible OLED)
  - TOLED (Transparent OLED)
  - PHOLED (Phosphorescent OLED)

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Flat-Panel Display Technologies

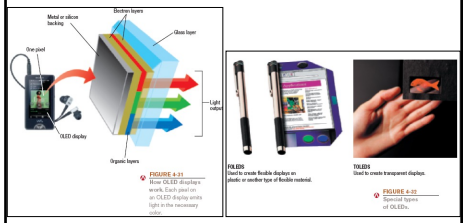

FIGURE 4-31 How OLED displays work. Each pixel on an OLED display emits light in the necessary color.

FIGURE 4-32 Special types of OLEDs.

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Flat-Panel Display Technologies

- Interferometric modulator displays (IMOD): Essentially a complex mirror that uses external light to display images
  - Designed initially for mobile phones and portable devices
  - Images are bright and clear, even in sunlight
- Plasma displays: Use layers of gas to display images
  - Most often used on large displays
- Surface-conduction electron-emitter displays (SED): Millions of tiny electron guns, similar to CRT
  - Thin, bright, less flicker than LCD or plasma

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Data and Multimedia Projectors

- Data projector: Display device that projects all computer output to a wall or projection screen
  - Found in classrooms, conference rooms
  - Can be wireless or integrated into devices
  - Integrated – tiny projectors built into mobile phones, portable devices
  - Hologram projectors used to display 3D images

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Printers

- Printers: Produce hard copy
- Printer characteristics
  - Printing technology used
    - Impact vs. nonimpact
  - Color vs. black and white
  - Personal vs. network printers
  - Print resolution (measured in dpi)
  - Print speed (measured in pages per minute (PPM))
  - Connection (USB, Ethernet, Wi-Fi, etc.)
  - Multifunction capabilities

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Laser Printers

- Laser printer: Uses toner powder and technology similar to that of a photocopier to produce images on paper
  - The standard for business documents
  - Print one entire page at a time
  - Generally faster and have better quality than ink-jet printers
  - Can be black and white or color
  - Common print resolution for laser printers is between 600 and 2,400 dpi
  - Use toner cartridges

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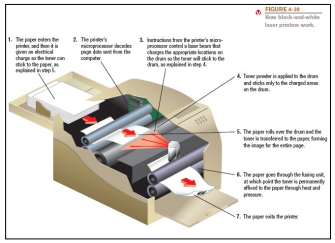
Laser Printers



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Ink-Jet Printers

- Ink-jet printer: Sprays droplets of ink to produce images on paper
  - Usually 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
  - Use ink-jet cartridges
- Newer printers with full width printheads are much faster
- Potential applications for the future
  - Dispensing liquid metal, aromas, computer chips and other circuitry, "printing" human tissue

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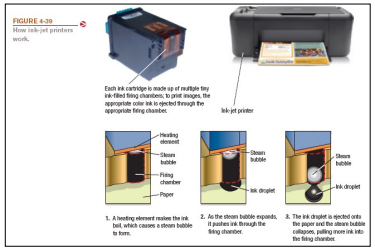
Ink-Jet Printers



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Special-Purpose Printers

- Photo printers
- Barcode, label, and postage printers
- Portable printers
- Plotters and wide-format ink-jet printers
- 3-D printers

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Audio Output

- Audio output: Output in the form of voice, music, and other audible sounds
  - Speakers
  - Headphones and headsets
  - Earphones and earbuds

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Quick Quiz

1. Which of the following types of display devices should have the largest footprint (the amount of room taken up on a desk)?
   a. CRT monitor
   b. OLED display
   c. LCD display
2. True or False: Laser printers can only print in black and white.
3. _____ printers form images with drops of liquid ink.

Answers:
1) a; 2) False; 3) Ink-jet printers

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Summary

- Keyboards
- Pointing and Touch Devices
- Scanners, Readers, and Digital Cameras
- Audio Input
- Display Devices
- Printers
- Audio Output

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