

CHAPTER 3: INPUT DEVICES

3.1 Introduction to Input Devices

A computer system cannot function independently without receiving data or instructions from the user or external environment. The process of entering data into a computer is known as **input**, and the hardware used for this purpose is called **input devices**.

Standard Definition

An input device is a hardware component used to enter data, instructions, or information into a computer system for processing.

3.2 Conceptual Understanding of Input

Input refers to any form of data or command that is supplied to a computer system.

Explanation

- Data may be numbers, text, images, or sound
- Instructions tell the computer what to do

Concept Insight

A computer cannot generate results without input. Therefore:

Input → Processing → Output

3.3 Role of Input Devices in Computer System

Input devices act as an interface between:

- Human users
- Computer system

Functions of Input Devices

1. Accept data from user
2. Convert data into machine-readable form
3. Send data to CPU for processing

3.4 Conversion Mechanism

Computers understand only binary language (0 and 1).

Input devices perform conversion:

Human Language → Machine Language

Example

Human Input	Converted Form
Typing "A"	Binary code
Speaking word	Digital signal
Image scan	Pixel data

3.5 Types of Input (Conceptual Classification)

Input can be classified into different forms:

Type	Description
Text Input	Letters, numbers
Audio Input	Voice, sound
Visual Input	Images, videos
Control Input	Commands and signals

3.6 Classification of Input Devices

Input devices can be broadly classified into:

1. Text Input Devices

- Used to enter text
- Example: Keyboard

2. Pointing Devices

- Used to control cursor
- Example: Mouse, Trackball

3. Scanning Devices

- Used to capture images or printed text
- Example: Scanner, OCR

4. Audio Input Devices

- Used to capture sound
- Example: Microphone

5. Specialized Input Devices

- Used for specific purposes
- Example: MICR, Barcode Reader

3.7 Peripheral Input Devices

Input devices are also called **peripheral devices** because they are external to the CPU but connected to it.

Definition

Peripheral input devices provide data and control signals to the computer system.

3.8 Importance of Input Devices

Without input devices:

- No data can enter the system
- No processing can occur
- No output can be generated

Concept Insight

Input devices are the starting point of the computing process.

3.9 Examples of Input Devices

Common input devices include:

- Keyboard
- Mouse
- Scanner
- Joystick
- Light Pen
- Trackball
- OCR
- MICR
- Barcode Reader

3.10 Characteristics of Input Devices

Feature	Description
Accuracy	Should capture correct data
Speed	Fast input capability
Ease of Use	User-friendly
Compatibility	Works with system

3.11 Input vs Output (Conceptual Difference)

Feature	Input Device	Output Device
Function	Enter data	Display result
Direction	User → Computer	Computer → User
Example	Keyboard	Monitor

3.15 Introduction to Keyboard

The keyboard is the most fundamental and widely used input device in a computer system. It is primarily used for entering text, numbers, and commands.

Definition

A keyboard is a text input device used to enter data and instructions into a computer system.

3.16 Historical Background of Keyboard

The modern keyboard is derived from typewriter technology.

- Invented by **Christopher Latham Sholes**
- Designed to improve typing efficiency

3.17 Basic Structure of Keyboard

A standard keyboard consists of multiple keys arranged in a specific layout.

Key Composition

Type of Key	Quantity
Alphabet Keys	26
Numeric Keys	10
Function Keys	12

3.18 Keyboard Layout (QWERTY)

The most commonly used keyboard layout is **QWERTY**, named after the first six letters of the top row.

Concept Insight

- Designed to reduce typing errors
- Prevent key jamming in early typewriters

3.19 Types of Keyboards

1. Wired Keyboard

- Connected via cable

2. Wireless Keyboard

- Uses Bluetooth or RF technology

3. Ergonomic Keyboard

- Designed for comfortable typing

4. Flexible Keyboard

- Made of soft material

3.20 Types of Keys on Keyboard

A keyboard is divided into different categories of keys:

1. Alphabet Keys

- Used to enter letters (A–Z)
- Form words and sentences

2. Numeric Keys

- Used to enter numbers (0–9)
- Available on both main keyboard and numeric keypad

3. Function Keys Located at the top of keyboard (F1 to F12)

Functions of Function Keys

Key	Function
F1	Help
F2	Rename
F3	Search
F4	Address bar / Menu
F5	Refresh
F6	Switch elements
F7	Spell check
F8	Boot options
F9	Email send/receive
F10	Activate menu bar
F11	Full screen mode
F12	Save As

4. Navigation Keys

Used to move cursor on screen.

Includes

- Arrow keys
- Home
- End
- Page Up
- Page Down

Functions

Key	Function
Arrow Keys	Move cursor
Home	Beginning of line
End	End of line
Page Up	Move up
Page Down	Move down

5. Control Keys (Modifier Keys)

These keys modify the function of other keys.

Examples

- Ctrl
- Shift
- Alt

6. Toggle Keys

Toggle keys switch between two states.

Examples

- Caps Lock
- Num Lock
- Scroll Lock

7. Special Keys

These keys perform special operations.

Examples and Functions

Key	Function
Enter	Execute command
Tab	Move cursor forward
Backspace	Delete left character
Delete	Delete right character

Esc	Cancel operation
Spacebar	Insert space

3.21 Concept of Character

Any letter, number, or symbol typed using keyboard is called a **character**.

3.22 Working Mechanism of Keyboard

When a key is pressed:

1. Electrical signal is generated
2. Signal is sent to CPU
3. CPU interprets the signal
4. Corresponding character appears on screen

3.23 Serial and Parallel Keyboards

- Serial Keyboard → Data transmitted one bit at a time
- Parallel Keyboard → Multiple bits transmitted simultaneously

3.24 Numeric Keypad

Located on right side of keyboard.

Features

- Faster numeric input
- Works with Num Lock

Concept Insight

When Num Lock is ON:

- Keys input numbers

When Num Lock is OFF:

- Keys act as navigation keys

3.25 Importance of Keyboard

- Primary input device
- Essential for text entry
- Used in all computing systems

3.26 Advantages of Keyboard

1. Easy to use
2. Fast input method
3. Accurate data entry
4. Widely available

3.27 Limitations of Keyboard

1. Requires typing skills
2. Not suitable for graphical input
3. Limited for complex data

3.30 Introduction to Mouse

The mouse is one of the most important pointing input devices used in modern computer systems. It allows the user to interact with graphical elements on the screen.

Definition

A mouse is a pointing input device used to control the movement of a cursor on a computer screen and to select or manipulate objects.

3.31 Historical Background of Mouse

- Invented by **Douglas C. Engelbart** in 1963–64
- Designed to simplify interaction with computers

3.32 Basic Structure of Mouse

A standard mouse consists of:

- Left button
- Right button
- Scroll wheel
- Sensor mechanism

3.33 Concept of Cursor and Pointer

Cursor

A blinking symbol on the screen that indicates where input will appear.

Pointer

An arrow-shaped symbol that moves with the mouse.

3.34 Working Mechanism of Mouse

The mouse works by detecting movement and converting it into signals.

Step-by-Step Working

1. Mouse is moved on surface
2. Sensor detects movement
3. Signals are sent to CPU
4. Cursor moves on screen

Deep Concept Insight

Movement is measured in terms of:

- Distance
- Direction
- Speed

These parameters are converted into digital signals.

3.35 Mouse as Pointing Device

Mouse is called a **pointing device** because it allows users to:

- Point to objects
- Select items
- Interact with graphical interface

3.36 Operations Performed by Mouse

1. Pointing

Moving the mouse to place the cursor on an object.

2. Clicking

Pressing and releasing a mouse button.

3. Drag and Drop

Holding the mouse button and moving an object to another location.

4. Scrolling

Using scroll wheel to move up or down the page.

3.37 Types of Mouse Click

Type	Function
Left Click	Select item
Right Click	Open menu
Double Click	Open file/program

3.38 Types of Mouse (Based on Technology)

1. Mechanical Mouse

- Uses a rubber or metal ball
- Movement of ball is detected

Working

- Ball rotates when mouse moves
- Sensors detect motion

2. Optical Mouse

- Uses LED or laser
- No moving parts

Working

- Light reflects from surface
- Sensor detects movement

3. Wireless Mouse

- Uses radio frequency or infrared
- No physical cable

3.39 Advanced Concept: Optical Tracking

Optical mouse uses:

- Light-emitting diode (LED)
- Camera sensor

Process

- Surface is scanned
- Images are compared
- Movement is calculated

3.40 Gyroscope Concept in Mouse

Modern devices may use gyroscope principle to detect motion.

Concept Insight

- Measures orientation and movement
- Used in advanced input devices

3.41 Mouse in Graphical User Interface (GUI)

Mouse plays a key role in GUI systems:

- Selecting icons
- Opening files
- Navigating menus

3.42 Mouse Pointer Shapes

The pointer changes shape based on action:

Shape	Meaning
Arrow	Normal selection
Hand	Link selection
I-beam	Text editing
Hourglass	Processing

3.43 Advantages of Mouse

1. Easy to use
2. Fast navigation
3. Supports graphical interaction
4. Improves user experience

3.44 Limitations of Mouse

1. Requires flat surface
2. Less useful for text input
3. Accuracy depends on user

3.45 Related Pointing Devices

Mouse is part of a larger category:

- Trackball
- Touchpad
- Light Pen
- Stylus

These devices perform similar functions.

3.48 Introduction to Advanced Pointing Devices

While the mouse is the most commonly used pointing device, several other devices are designed to perform similar functions under different conditions and applications.

These devices are collectively known as **pointing devices**, as they allow users to control the position of the pointer or cursor on the screen.

3.49 Concept of Pointing Devices

Definition

Pointing devices are input devices used to control the movement of the cursor and to interact with graphical elements on a display.

Key Functions

- Move pointer
- Select objects
- Control graphical interface
- Perform interactive operations

3.50 Trackball

Definition

A trackball is a pointing device that consists of a stationary base with a movable ball on top, which is rotated using fingers or palm.

Structure

- Fixed base
- Rotating ball
- Sensors

Working Mechanism

1. User rotates the ball
2. Sensors detect movement
3. Signals are sent to CPU
4. Cursor moves accordingly

Concept Insight

Unlike mouse:

- Device remains stationary
- Only ball moves

Applications

- Medical systems
- Computer-Aided Design (CAD)
- Industrial control systems

Advantages

1. Requires less space
2. High precision control
3. Suitable for limited movement areas

Limitations

1. Requires practice
2. Less intuitive than mouse

3.51 Touchpad

Definition

A touchpad is a flat surface that detects finger movement to control the cursor.

Location

- Commonly found in laptops

Working Mechanism

- Detects finger movement using capacitive sensors
- Converts motion into cursor movement

Features

- Tap to click
- Multi-touch gestures
- Scroll using finger movement

Advantages

1. No external device required

2. Compact and portable
3. Integrated in laptops

Limitations

1. Lower precision compared to mouse
2. Not suitable for long usage

3.52 Joystick

Definition

A joystick is an input device consisting of a lever that can be moved in multiple directions to control movement on screen.

Structure

- Stick (lever)
- Base
- Control buttons

Working Mechanism

- Movement of stick generates directional signals
- CPU interprets movement

Applications

- Computer games
- Flight simulators
- Robotics control

Concept Insight

Joystick detects:

- Angle
- Direction
- Speed of movement

Advantages

1. Precise directional control
2. Ideal for gaming
3. Supports real-time interaction

Limitations

1. Limited use outside gaming
2. Requires training

3.53 Light Pen

Definition

A light pen is an input device that uses a light-sensitive detector to select or draw objects on a screen.

Structure

- Pen-like device
- Photocell
- Optical system

Working Mechanism

1. Pen touches screen
2. Light is detected
3. Position is identified
4. Input is recorded

Applications

- Graphic design
- Smart boards
- Digital drawing

Advantages

1. Direct interaction with screen
2. High accuracy
3. Useful for drawing

Limitations

1. Works only with specific screens
2. Less common in modern systems

3.54 Stylus Pen

Definition

A stylus is a pen-shaped input device used to interact with touch screens and digitizers.

Working Mechanism

- Touch-sensitive surface detects stylus movement
- Converts it into digital signals

Applications

- Smartphones
- Tablets
- Graphic tablets

Advantages

1. Precise input
2. Ideal for drawing and writing
3. Better than finger input

Limitations

1. Can be misplaced
2. Requires compatible device

3.55 Comparison of Pointing Devices

Device	Movement Type	Precision	Usage
Mouse	Surface movement	Medium	General use
Trackball	Ball rotation	High	CAD
Touchpad	Finger motion	Medium	Laptops
Joystick	Directional lever	High	Gaming
Light Pen	Direct screen	High	Drawing
Stylus	Touch-based	Very High	Design

3.59 Introduction to Scanning Devices

Scanning devices are a category of input devices used to convert physical documents, images, or text into digital format that can be processed by a computer.

Definition

A scanner is an optical input device that reads text, images, or drawings from paper and converts them into digital form.

3.60 Need for Scanning Devices

Manual data entry is:

- Time-consuming
- Error-prone

Scanning devices solve this problem by:

- Automatically capturing data
- Converting it into digital format

3.61 Working Principle of Scanner

Scanner works on the principle of **optical scanning using light**.

Step-by-Step Working

1. Document is placed on scanner
2. Light source illuminates document
3. Reflected light is captured by sensors
4. Signals are converted into digital data

5. Data is stored in computer

Deep Concept Insight

- Light intensity represents data
- Dark areas absorb light
- Light areas reflect light

This difference is converted into binary data.

3.62 Components of Scanner

- Light source (usually fluorescent lamp)
- Optical sensor (CCD or CIS)
- Mirror system
- Analog to digital converter

3.63 Types of Scanner

1. Flatbed Scanner

Definition

A flatbed scanner is a desktop scanner with a glass surface where documents are placed.

Features

- Looks like photocopier
- High-quality scanning
- Widely used

Working

- Document placed on glass
- Lid is closed
- Scanner moves light across document

Applications

- Offices
- Schools
- Document scanning

3.64 Sheet-fed Scanner

Definition

A sheet-fed scanner feeds paper through the scanner instead of placing it on glass.

Features

- Similar to fax machine
- Suitable for multiple pages

Advantages

- Faster scanning
- Useful for bulk documents

Limitation

- Cannot scan books or thick objects

3.65 Handheld Scanner

Definition

A handheld scanner is a portable device that is moved manually over the document.

Features

- Compact
- Portable
- Manual operation

Applications

- Field work
- Portable scanning

Limitation

- Lower accuracy
- Requires steady hand

3.66 Optical Scanner Concept

All scanners are optical devices because they use light to capture data.

Definition

An optical scanner reads text or images using a light source and converts them into digital form.

3.67 Image to Digital Conversion

Process

- Image is divided into pixels
- Each pixel is assigned value
- Values are stored digitally

Concept Insight

More pixels → Better image quality

3.68 Resolution of Scanner

Definition

Resolution refers to the detail captured by scanner.

Unit

DPI (Dots Per Inch)

Example

DPI	Quality
300 DPI	Standard
600 DPI	High
1200 DPI	Very High

3.69 Advantages of Scanner

1. Fast data input
2. High accuracy
3. Supports image and text input
4. Reduces manual work

3.70 Limitations of Scanner

1. Requires proper alignment
2. High-quality scanners are costly
3. Cannot interpret data without software

3.71 Applications of Scanner

- Document digitization
- Image processing
- Data storage
- Online submission

3.72 Scanner vs Keyboard

Feature	Scanner	Keyboard
Input Type	Image/text	Text
Speed	Fast	Moderate
Accuracy	High	Depends on user

3.75 Introduction to Optical Input Devices

Optical input devices are specialized devices that use **light-based technology** to read data from physical sources and convert it into digital form.

Definition

Optical input devices are devices that use light to scan, detect, and convert printed or written data into machine-readable format.

3.76 Need for Optical Input Devices

Traditional input methods like keyboard:

- Require manual effort
- Are time-consuming

Optical devices:

- Automate data input
- Increase speed and accuracy

3.77 Optical Mark Reader (OMR)

Definition

OMR is an input device that detects marks made on paper using light reflection technology.

Working Principle

- Light is projected on paper
- Marked areas reflect less light
- Sensors detect differences
- Data is interpreted

Example

Objective-type answer sheets:

- Filled bubbles are detected

Applications

- Competitive exams
- Surveys
- Voting systems

Advantages

1. High speed
2. High accuracy
3. Efficient for bulk data

Limitations

1. Only detects marks
2. Requires proper marking

3.78 Optical Character Recognition (OCR)

Definition

OCR is an input device that reads printed or handwritten text and converts it into editable digital text.

Inventor

Developed by **E. G. Burg**

Working Mechanism

1. Document is scanned
2. Characters are identified
3. Converted into ASCII code
4. Stored as editable text

Concept Insight

OCR performs:

- Pattern recognition
- Character identification

Applications

- Digitizing books
- Document editing
- Data entry automation

Advantages

1. Converts printed text into editable form
2. Reduces manual typing
3. Saves time

Limitations

1. Errors in handwritten text
2. Requires clear image

3.79 Barcode Reader

Definition

A barcode reader is an input device that reads barcodes using optical scanning and converts them into digital data.

Concept of Barcode

- Series of parallel lines
- Represents numerical or alphanumeric data

Working Mechanism

1. Laser light scans barcode
2. Reflected light is captured
3. Pattern is decoded
4. Data is sent to computer

Applications

- Supermarkets
- Warehouses
- Inventory systems

Advantages

1. Fast and accurate
2. Reduces human error
3. Automates billing

Limitations

1. Requires clear barcode
2. Limited data capacity

3.80 Magnetic Ink Character Recognition (MICR)

Definition

MICR is an input device that reads characters printed with magnetic ink, mainly used in banking systems.

Working Principle

- Characters printed using magnetic ink
- Machine reads magnetic signals
- Converts into digital data

Structure of MICR Code

Digits	Meaning
First 3	City code
Next 3	Bank code
Last 3	Branch code

Applications

- Cheque processing
- Banking systems

Advantages

1. High accuracy
2. Secure processing
3. Fast verification

Limitations

1. Requires special ink
2. Limited to banking use

3.81 Comparison of Optical Devices

Device	Function	Application
OMR	Reads marks	Exams
OCR	Reads text	Document processing
Barcode Reader	Reads codes	Retail
MICR	Reads magnetic text	Banking

3.82 Conceptual Understanding

All optical devices follow similar process:

Light → Reflection → Detection → Conversion → Data

3.85 Introduction to Audio Input Devices

Audio input devices are used to capture sound signals such as human speech, music, or environmental noise and convert them into digital form that a computer can process.

Definition

An audio input device is a hardware component that captures sound and converts it into digital signals for computer processing.

3.86 Concept of Audio Input

Sound is a form of energy that travels in the form of waves. Computers cannot understand sound directly; therefore, it must be converted into electrical and then digital signals.

Conversion Process

Sound Waves → Electrical Signals → Digital Data

3.87 Microphone

Definition

A microphone is an input device used to capture sound and convert it into electrical signals.

3.88 Working Mechanism of Microphone

The microphone works in the following steps:

1. Sound waves enter the microphone
2. Diaphragm vibrates
3. Vibrations are converted into electrical signals
4. Signals are digitized by computer

Deep Concept Insight

The microphone acts as a **transducer**, converting one form of energy (sound) into another (electrical).

3.89 Types of Microphones (Conceptual)

1. Dynamic Microphone

- Uses electromagnetic induction
- Durable and widely used

2. Condenser Microphone

- Uses capacitor principle
- High sensitivity

3.90 Applications of Microphone

- Voice recording
- Video conferencing
- Online communication
- Voice commands

3.91 Advantages of Microphone

1. Enables voice input
2. Fast data entry
3. Natural interaction

3.92 Limitations of Microphone

1. Sensitive to noise
2. Requires clear speech
3. Accuracy depends on environment

3.93 Speech Recognition System

Definition

Speech recognition is a technology that converts spoken words into digital text or commands.

3.94 Working of Speech Recognition

Step-by-Step Process

1. User speaks into microphone
2. Sound is captured
3. Converted into digital signals
4. Software analyzes patterns
5. Words are recognized
6. Output is generated

3.95 Core Technology Behind Speech Recognition

Speech recognition uses:

- Pattern recognition
- Artificial intelligence
- Signal processing

3.96 Types of Speech Recognition Systems

1. Speaker Dependent

- Trained for a specific user

2. Speaker Independent

- Works for any user

3.97 Applications of Speech Recognition

- Virtual assistants

- Voice typing
- Accessibility systems
- Smart devices

3.98 Advantages of Speech Recognition

1. Hands-free operation
2. Fast input method
3. Useful for disabled users

3.99 Limitations of Speech Recognition

1. Accuracy affected by noise
2. Language dependency
3. Requires training

3.100 Voice Input vs Keyboard Input

Feature	Voice Input	Keyboard Input
Speed	Faster	Moderate
Accuracy	Depends on system	High
Effort	Less	More

3.101 Example

Voice typing:

- User speaks sentence
- System converts into text
- Text appears on screen

3.102 Conceptual Understanding

Voice input system works as:

Speech → Microphone → Digital Conversion → Recognition → Output

3.105 Introduction to Advanced Input Devices

With the advancement of technology, input devices have evolved beyond traditional devices like keyboard and mouse. Modern systems require devices that can handle:

- Visual input
- Touch-based interaction
- Real-time data capture

These devices are collectively referred to as **advanced input devices**.

3.106 Digital Camera

Definition

A digital camera is an input device used to capture images and store them in digital format.

3.107 Working Mechanism of Digital Camera

1. Light enters through lens
2. Image sensor captures light
3. Signals are converted into digital data
4. Image is stored in memory

Core Concept

Light → Sensor → Digital Conversion → Image File

3.108 Features of Digital Camera

- High-resolution image capture
- Instant preview
- Easy data transfer

3.109 Applications of Digital Camera

- Photography
- Video recording
- Surveillance
- Online communication

3.110 Web Camera (Webcam)

Definition

A webcam is a digital camera connected to a computer used for capturing live video and images.

Applications

- Video conferencing
- Online classes
- Live streaming

Concept Insight

Webcam captures real-time data and sends it directly to computer.

3.111 Touch Screen

Definition

A touch screen is both an input and output device that allows users to interact with a computer by touching the display.

3.112 Types of Touch Screen Technology

1. Resistive Touch Screen

- Works on pressure
- Two layers come in contact

2. Capacitive Touch Screen

- Works on electrical charge
- Detects finger touch

3.113 Working Mechanism of Touch Screen

1. User touches screen
2. Sensors detect touch position
3. Signal is sent to CPU
4. Action is performed

3.114 Advantages of Touch Screen

1. Direct interaction
2. Easy to use
3. Fast input

3.115 Limitations of Touch Screen

1. Finger marks on screen
2. Less precise than stylus
3. Expensive

3.116 Digitizer

Definition

A digitizer is an input device that converts analog data into digital form.

Working Mechanism

- Captures analog signals
- Converts into binary data
- Sends to computer

Applications

- Engineering design
- Graphic creation
- Image processing

3.117 Graphics Tablet

Definition

A graphics tablet is an input device that allows users to draw images and graphics using a stylus.

Components

- Drawing surface
- Stylus pen

Working Mechanism

- Stylus movement is detected
- Signals are converted into digital form
- Image appears on screen

Applications

- Digital art
- Animation
- Signature input

3.118 Stylus and Graphics Tablet Relationship

- Stylus acts as input tool
- Graphics tablet acts as input surface

3.119 Comparison of Advanced Devices

Device	Function	Usage
Digital Camera	Capture images	Photography
Webcam	Live video	Communication
Touch Screen	Direct input	Mobile devices
Digitizer	Analog to digital	Engineering
Graphics Tablet	Drawing input	Design

3.120 Conceptual Understanding

All advanced devices perform:

Physical Action → Signal Conversion → Digital Input

3.121 Advantages of Advanced Input Devices

1. Faster interaction
2. Improved user experience
3. Supports multimedia input

3.122 Limitations of Advanced Devices

1. Costly
2. Requires advanced systems
3. Maintenance required

3.126 Concept of Specialized Input

Specialized input devices are used when:

- High security is required
- Automated processing is needed
- Large-scale transactions are involved

3.127 Smart Card

Definition

A smart card is a plastic card embedded with a microchip that stores and processes data.

3.128 Smart Card Reader (SCR)

Definition

A smart card reader is a device used to read data stored in smart cards.

Working Mechanism

1. Card is inserted or tapped
2. Reader accesses chip data
3. Data is transmitted to computer
4. System processes information

Applications

- Banking (ATM, debit/credit cards)
- Identity verification
- Access control systems

Advantages

1. Secure data storage
2. Fast transaction processing
3. Portable

Limitations

1. Requires compatible reader
2. Risk of physical damage

3.129 Magnetic Stripe Card and Reader

Definition

A magnetic stripe card stores data in a magnetic strip, which is read by a card reader.

Working Mechanism

- Card is swiped
- Magnetic data is read
- Information is processed

Applications

- ATM cards
- Credit cards
- ID cards

3.130 QR Code (Quick Response Code)

Definition

A QR code is a two-dimensional barcode used to store information that can be read by scanning devices.

3.131 Structure of QR Code

- Square pattern
- Black and white modules
- Encodes data in matrix form

Concept Insight

QR code stores:

- Text
- URLs
- Payment information

3.132 Working Mechanism of QR Code

1. QR code is scanned
2. Image is processed
3. Data is decoded
4. Output is generated

Applications

- Digital payments
- Product tracking
- Ticketing systems

Advantages

1. Stores large data
2. Fast scanning
3. Error correction capability

Limitations

1. Requires scanning device
2. Dependent on image quality

3.133 Barcode vs QR Code

Feature	Barcode	QR Code
Dimension	1D	2D
Data Capacity	Low	High
Speed	Moderate	Fast
Usage	Retail	Payments

3.134 Electronic Card Reader

Definition

An electronic card reader is a device used to read data stored in electronic cards such as ATM or ID cards.

Features

- Reads magnetic or chip-based data
- Used in automated systems

3.135 Kimball Tag Reader

Definition

A Kimball tag reader reads punched tags attached to products, especially in clothing stores.

Working

- Tag is scanned
- Data is read
- Used for billing and inventory

3.136 Role of Specialized Devices in Automation

These devices enable:

- Fast transactions
- Reduced human intervention
- Increased efficiency

3.137 Conceptual Understanding

Specialized devices follow this process:

Data Source → Device → Signal Conversion → Processing

3.138 Advantages of Specialized Input Devices

1. High speed
2. High accuracy
3. Secure processing
4. Suitable for large-scale operations

3.139 Limitations of Specialized Devices

1. Limited to specific tasks
2. Requires infrastructure
3. Higher cost

3.142 Integrated Concept of Input Devices

After studying all categories of input devices, it is essential to understand them as part of a unified system rather than as isolated components.

Integrated Definition

Input devices are hardware components that:

- Capture data or instructions
- Convert them into machine-readable form
- Transmit them to the CPU for processing

3.143 Complete Input Flow in Computer System

The overall flow of input can be represented as:

User Action → Input Device → Signal Conversion → CPU Processing

3.144 Classification Summary of Input Devices

Input devices can be grouped into categories based on their functionality:

Category	Devices
Text Input	Keyboard
Pointing Devices	Mouse, Trackball, Touchpad
Optical Devices	OCR, OMR, Barcode
Audio Devices	Microphone
Scanning Devices	Scanner
Specialized Devices	Smart Card, QR Code
Advanced Devices	Touch Screen, Digitizer

3.145 Comparative Analysis of Input Devices

Device	Input Type	Speed	Accuracy	Application
Keyboard	Text	Mode rate	High	General
Mouse	Pointing	Fast	Medium	GUI
Scanner	Image	Fast	High	Document
OCR	Text Recognition	Fast	Medium	Digitization
OMR	Mark Detection	Very Fast	High	Exams
MICR	Magnetic Text	Fast	Very High	Banking
Microphone	Audio	Fast	Medium	Voice input

Touch Screen	Direct Input	Fast	Medium	Mobile
Barcode Reader	Code	Fast	High	Retail

3.146 Functional Differences of Input Devices

Based on Input Method

- Manual Input → Keyboard
- Motion-Based Input → Mouse
- Light-Based Input → Scanner
- Sound-Based Input → Microphone

3.147 Conceptual Relationship Between Input Devices

All input devices follow a common process:

Physical Input → Signal Conversion → Digital Data → Processing

3.148 Input Devices and User Interaction

Input devices determine how users interact with computers.

Types of Interaction

Interaction Type	Device
Typing	Keyboard
Pointing	Mouse
Touch	Touch screen
Voice	Microphone

3.149 Input Device Selection Criteria

Choosing an input device depends on:

1. Nature of task
2. Required accuracy
3. Speed requirement
4. User comfort

3.150 Input Devices in Modern Computing

Modern systems use multiple input devices simultaneously:

- Keyboard + Mouse

- Touch + Voice
- Camera + Scanner

3.151 Role of Input Devices in Automation

Input devices are essential for automation:

- Reduce manual work
- Increase efficiency
- Improve accuracy

3.152 Real-Life Integrated Example

Online shopping system:

1. Keyboard → Enter search
2. Mouse → Select product
3. Barcode → Scan item
4. Card reader → Payment

3.153 Advantages of Input Devices (Overall)

1. Enable data entry
2. Improve speed
3. Enhance user interaction
4. Support automation

3.154 Limitations of Input Devices

1. Some require training
2. Accuracy depends on device quality
3. Some devices are expensive