



Studybeesofficial

Where Minds Pollinate

Class 12
Computer 

Chapter 1
Computer system
notes

Follow Our Socials



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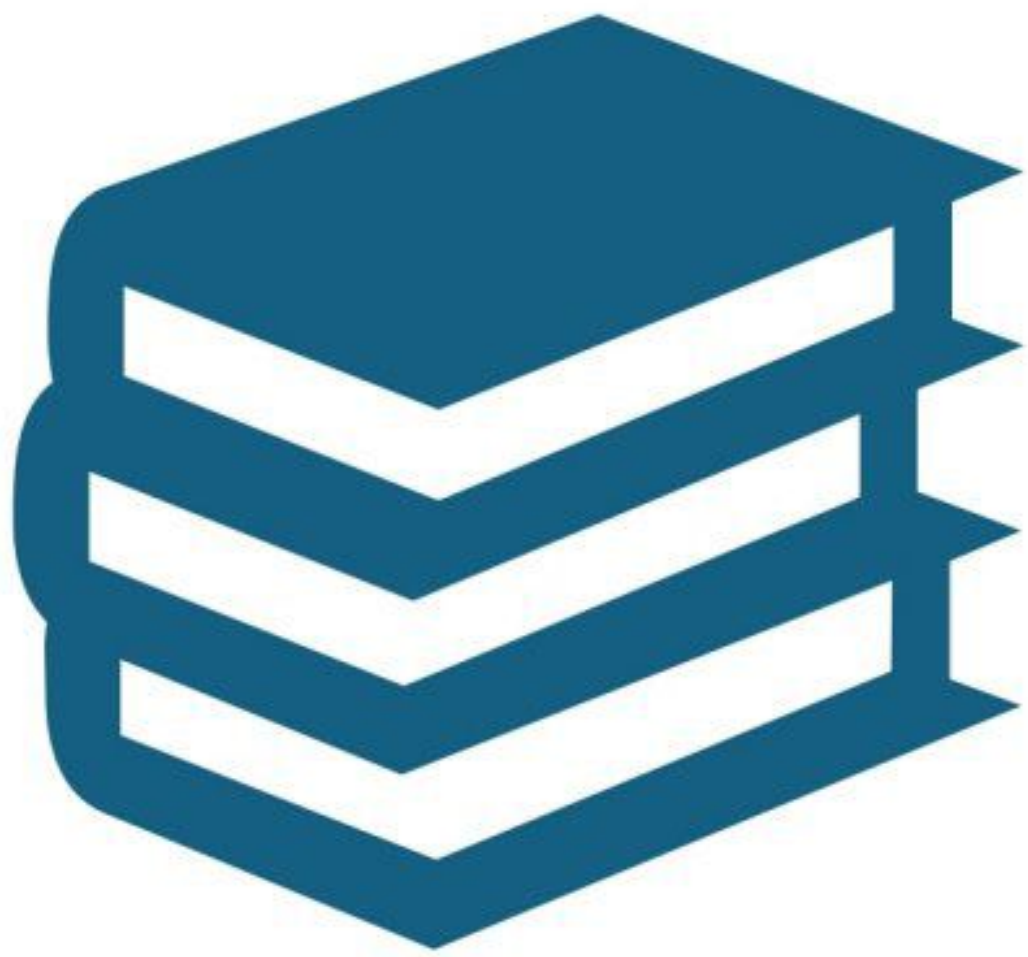


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Computer System
Chapter 1

Key Concepts for System Interaction

1. Usability

- Usability is how **easy, efficient, and satisfying** it is for users to interact with a system.
- **Key Aspects:**
 - Learnability (how easy it is to learn)
 - Efficiency (how fast you can perform tasks)
 - Error prevention and recovery
- **Example:**
Google Search is highly usable — you simply type in a query and get results instantly. No training is needed.
- ✓ **Good usability** makes systems friendly and productive.

Key Concepts for System Interaction

2. Security

- Security in system interaction means **protecting user data and system resources** from unauthorized access, loss, or attack.

- **Key Aspects:**

- Password protection
- Data encryption
- User authentication
- Firewall and antivirus systems

- **Example:**

Online banking apps use **two-factor authentication** to ensure only the account owner can log in.



Strong security builds user trust and prevents fraud or cyberattacks.

Key Concepts for System Interaction

3. Accessibility

Accessibility ensures that **people with different abilities** (visual, hearing, mobility, cognitive) can use the system **equally and effectively**.

- **Key Aspects:**

- Screen reader support
- Keyboard navigation
- Text alternatives (alt text for images)
- Color contrast and font size adjustments

- **Example:**

A government website includes a "**high contrast mode**" and is fully usable with a screen reader for visually impaired users.

 **Accessible systems** promote digital inclusion and fairness.



Key Concept	What It Means	Real-Life Example
Usability	Easy, efficient, satisfying to use	Google search: fast and intuitive
Security	Protection from data theft or attacks	Banking app with 2FA
Accessibility	Useable by people with disabilities	Screen-reader-friendly website for the blind



Key Aspects of Usability

Usability Goal

Description

Example

Effectiveness

How accurately and completely a user can achieve their goals using the system.

A student is able to submit an assignment through an app without missing steps.

Efficiency

How quickly and with how little effort a task can be completed once learned.

Booking a flight in just 3 steps instead of 10.

Satisfaction

How pleasant and comfortable the system is to use.

A colorful, easy-to-navigate shopping app makes users happy to use it again.

Principles of Usability

- User-friendly, ensure they meet the need and expectations of users.

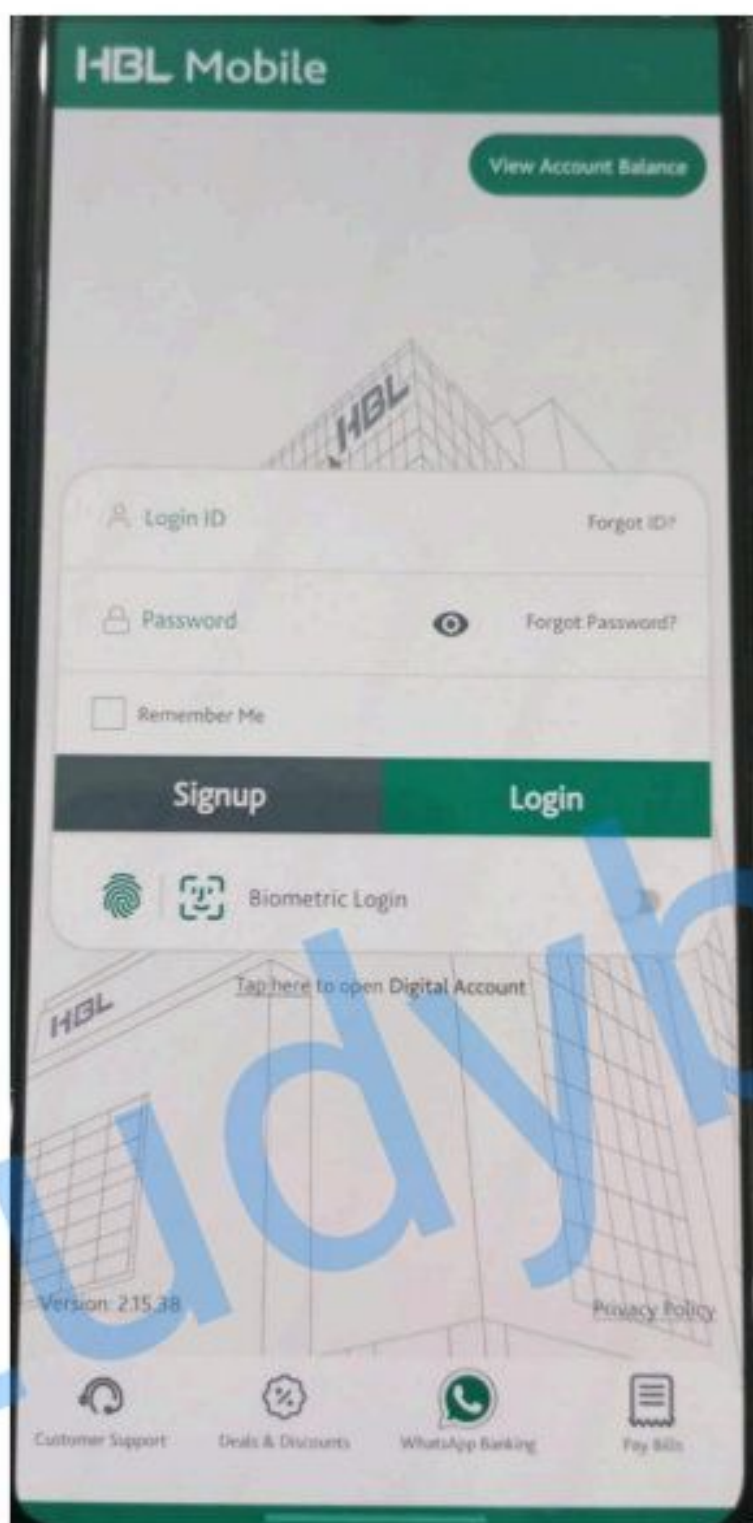
1. Simplicity

The interface should be **easy to use and not overloaded** with unnecessary elements or complex features.

- **Example:**

Google homepage has just a search bar and two buttons — no clutter. Users know exactly what to do.

- **Impact:** Reduces confusion and speeds up user interaction.



Principles of usability

2.Consistency

Elements like buttons, icons, and terminology should **behave and appear the same** across all parts of the system.

- **Example:**

In **Microsoft Office**, the **“Save” icon** looks and works the same in Word, Excel, and PowerPoint.

- **Impact:** Helps users transfer their knowledge from one part of the system to another.

Principles of usability

3. Feedback

The system should give **immediate and clear responses** to user actions, so they know what's happening.

- **Example:**

When you click "Send" in Gmail, it shows a "**Message Sent**" confirmation at the bottom.

➤ **Impact:** Builds user confidence and prevents confusion.

Principles of usability

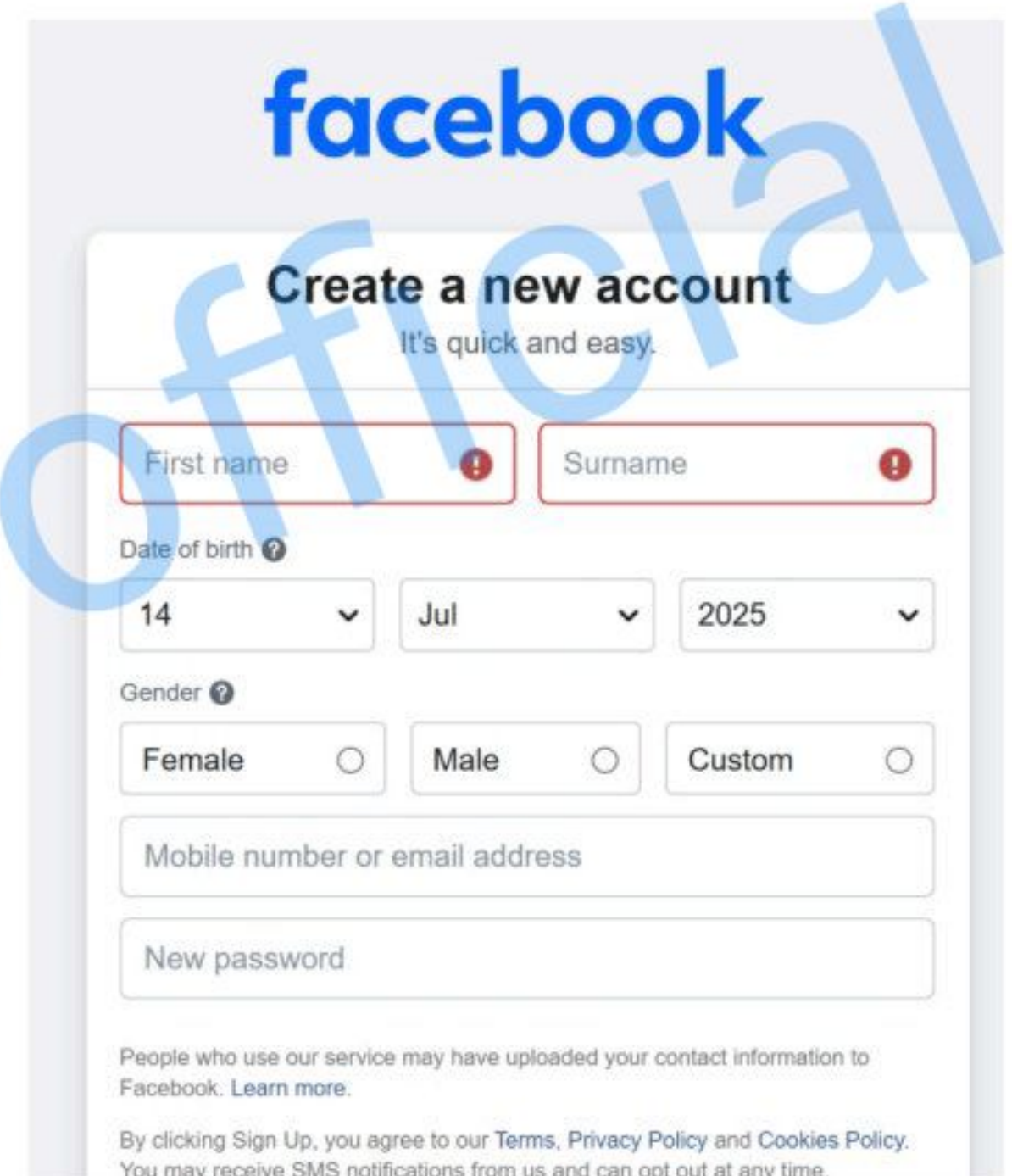
- **Error Prevention**

Design the system to **reduce the chances of errors** and make it hard to make mistakes.

- **Example:**

An online form **disables the “Submit” button** until all required fields are filled correctly.

➤ **Impact:** Saves time and reduces frustration.



The image shows a screenshot of the Facebook 'Create a new account' form. The form is titled 'facebook' in blue, followed by 'Create a new account' and the tagline 'It's quick and easy.' Below the title, there are two input fields for 'First name' and 'Surname', both of which are highlighted with red borders and red exclamation mark icons, indicating they are required and currently empty. Below these are three dropdown menus for 'Date of birth' (showing '14', 'Jul', and '2025'). Below the date fields are three radio button options for 'Gender': 'Female', 'Male', and 'Custom'. Below the gender options are two text input fields: 'Mobile number or email address' and 'New password'. At the bottom of the form, there is a small disclaimer: 'People who use our service may have uploaded your contact information to Facebook. Learn more.' and a line of text: 'By clicking Sign Up, you agree to our Terms, Privacy Policy and Cookies Policy. You may receive SMS notifications from us and can opt out at any time.'

Principles of usability

5. Learnability

The system should be **easy to learn**, even for first-time users.

- **Example:**

Most **mobile apps** use intuitive gestures like **swipe**, **tap**, and **drag** that users can understand quickly without a manual.

➤ **Impact:** Reduces training time and makes onboarding easier.

Principles of usability

6. Accessibility

The system should be **usable by people with various abilities**, including those with disabilities.

- **Example:**

YouTube offers **captions and subtitles** for hearing-impaired users, and **keyboard shortcuts** for navigation.

➤ **Impact:** Promotes inclusiveness and legal compliance.

Principles of Usability

Principle	Description	Real-Life Example
Simplicity	Minimal and focused design	Google homepage
Consistency	Same layout/behavior across the system	Microsoft Office toolbar
Feedback	Immediate response to user actions	Gmail "Message Sent" popup
Error Prevention	Preventing mistakes before they happen	Submit button disabled until form is filled
Learnability	Easy to understand and use quickly	Swipe gestures on mobile apps
Accessibility	Inclusive design for all users	Captions on YouTube videos

Types of Usability Testing

1. Moderated Usability Testing

A **facilitator (moderator)** guides the user through tasks in real-time, often in a lab or virtual setting.

- **Example:**

A **company launching a new e-learning platform** invites students to perform tasks (e.g., "Find your grades"). A researcher observes their behavior, asks questions, and notes where they struggle.

➤ **Best for:** Deep insights, real-time feedback, clarifying user confusion.

Types of Usability Testing

2. Unmoderated Usability Testing

Users perform tasks **on their own**, without a facilitator, often from their home or workplace.

- **Example:**

An app developer sends out a usability test link to 100 users with instructions like “Sign up, explore features, and post a comment.” The system records actions and collects feedback automatically.

➤ **Best for:** Large-scale testing, quick and cost-effective feedback.

Types of Usability Testing

3. Qualitative Usability Testing

Focuses on **user opinions, behaviors, and experiences** rather than numbers. It answers “**Why did the user behave this way?**”

- **Example:**

During a test, a user says, “I find the ‘Buy Now’ button confusing because it's too small.” This verbal feedback helps improve the design.

➤ **Best for:** Understanding **user feelings**, pain points, and suggestions.

Types of Usability Testing

4. Quantitative Usability Testing

Focuses on **measurable data** like time to complete tasks, error rates, click counts, and satisfaction scores.

- **Example:**

An airline website is tested by 50 users:

- **Average time to book a ticket:** 2 minutes
- **Task completion rate:** 92%
- **Average errors per task:** 1.2

➤ **Best for:** Measuring performance and comparing versions.

Types of Usability Testing

5. Remote Usability Testing

- **Explanation:**

Users test the product from their own environment (home, office), using screen-sharing or remote testing tools.

- **Example:**

A startup testing a health tracking app shares a link with users worldwide. The sessions are recorded via Zoom or Lookback.

➤ **Best For:** Real-world scenarios, geographically spread users

Types of Usability Testing

6. A/B Testing

Users are shown **two different versions (A and B)** of a web page or app feature to see which performs better.

- **Example:**

Version A has a green "Buy Now" button; Version B has a red one. After testing, it's found that **Version A has 25% more clicks.**

➤ **Best For:** Testing design changes, conversion optimization

Types of Usability Testing

Type	What It Measures	Real-Life Example
Moderated	User behavior with guidance	Live session with a researcher for app test
Unmoderated	Self-guided user interaction	Users test a travel site from home
Qualitative	Feelings, preferences, feedback	Post-task interviews or think-alouds
Quantitative	Time, error rates, satisfaction scores	Booking time on a train website
Remote	Real-world usage in user's own setting	Remote screen recording of app interaction
A/B Testing	Which version performs better	Green vs. red call-to-action buttons

Feature	Quantitative Usability Testing	A/B Testing
Definition	Measures numerical data on how users interact with a system	Compares two (or more) versions of a system to see which performs better
Goal	Understand how well a system performs using metrics	Identify which version is more effective or preferred
Focus	Overall usability performance	Design or feature choice comparison
Examples of Metrics	Time on task, error rate, success rate, satisfaction score	Click-through rate, conversion rate, bounce rate
Test Setup	Users perform a series of tasks , data is recorded	Users are randomly shown Version A or B , and outcomes are tracked
Example	Measuring how long users take to book a flight	Testing which "Buy Now" button color leads to more clicks
Best For	Benchmarking, identifying performance issues	Testing minor changes (designs, wording, layouts)

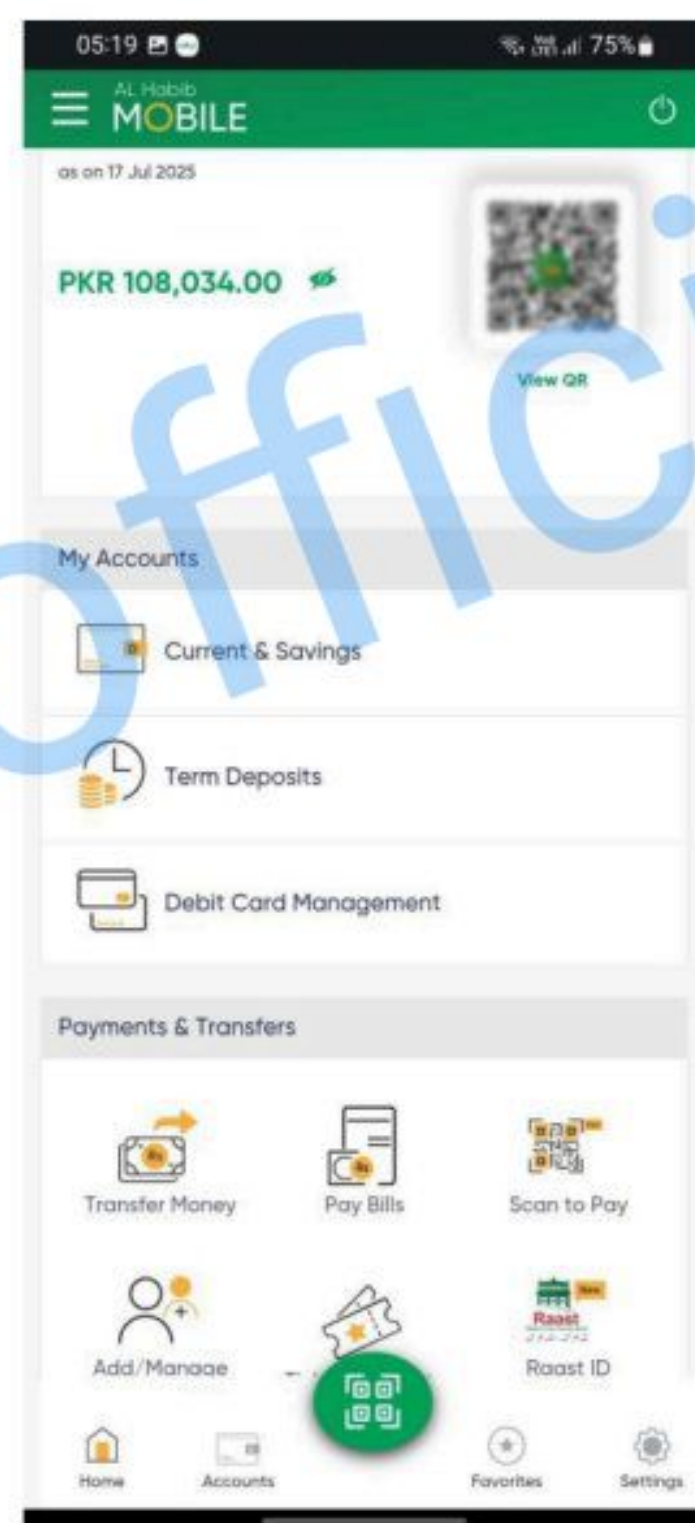
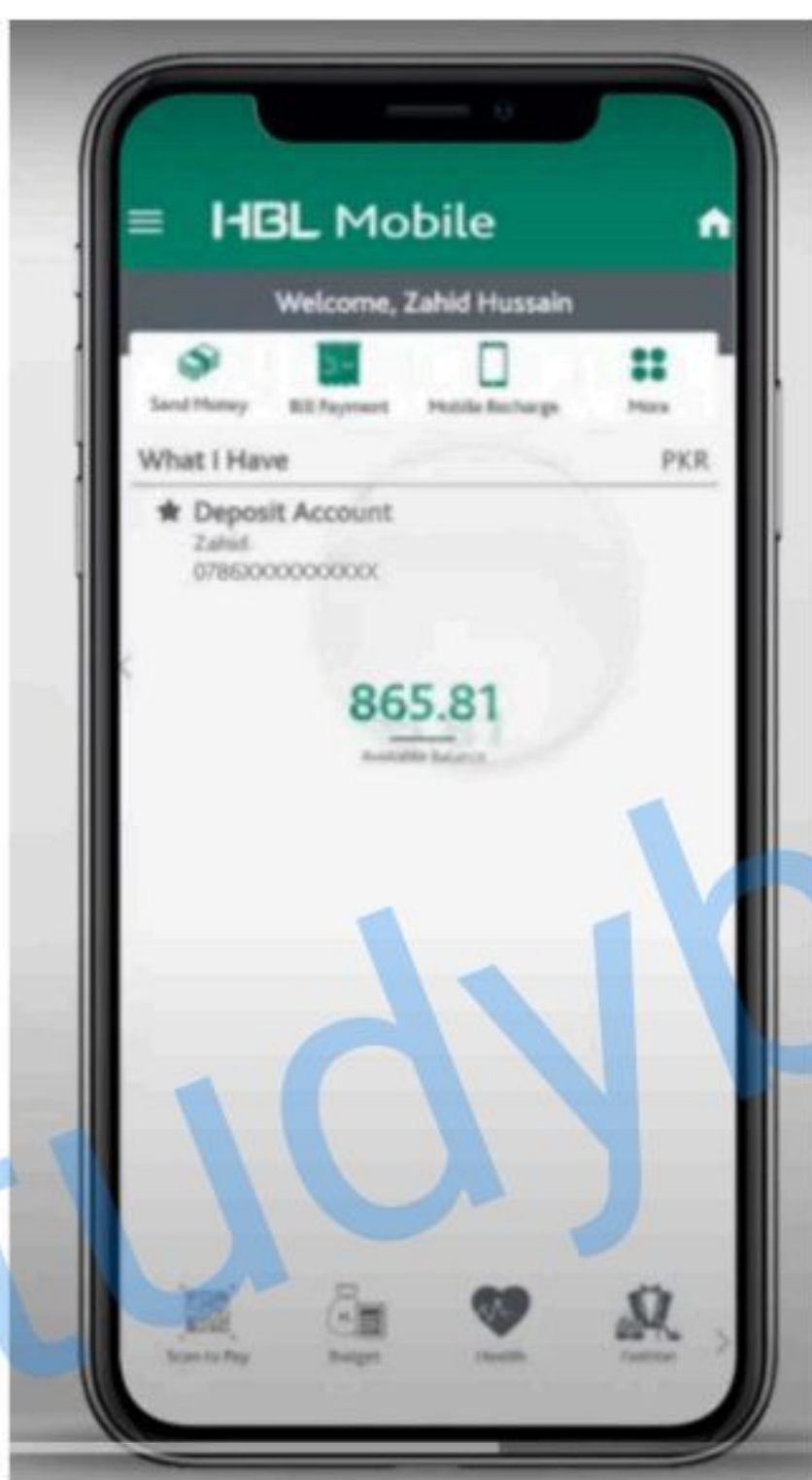
Class Activity: Use Case Scenarios for Usability Testing Types

1. A teacher observes students using a new educational website and asks them questions while they perform tasks like signing up or submitting assignments.
2. Students at home access a school management system and their interactions are recorded via screen sharing or automated tools.
3. After using a language learning app, students are interviewed to share what they liked, found confusing, or would improve.
4. Students use a mobile quiz app on their own, and their screen actions and feedback are recorded without live supervision.
5. Half the class sees version A of an online assignment submission form, while the other half sees version B. Teacher checks which version is easier/faster to use.
6. Students are timed while completing a task on a science learning portal. Data like success rate and number of clicks are collected.

Common Usability Issues & How to Avoid:

1. Complex Interfaces

- **Problem:**
Overloaded or cluttered interfaces confuse users, increase cognitive load, and make systems harder to use.
- **Real-World Example:**
A banking app with too many menus, tabs, and technical jargon makes it difficult for new users to find how to transfer money.
- **How to Avoid:**
 - Use **minimalist design** with only essential features.
 - Group related functions together.
 - Use **clear icons and labels**.



Common Usability Issues & How to Avoid:

2. Inconsistent Navigation

- **Problem:**

If navigation elements (menus, buttons, links) behave or appear differently across pages, users get lost or frustrated.

- **Real-World Example:**

An online store uses “Add to Cart” on one page and “Buy Now” on another — leading to confusion about their function.

- **How to Avoid:**

- Use **consistent labels**, placement, and design.
- Maintain **uniform navigation structure** across the system.
- Follow **UI guidelines** (e.g., Android or iOS standards).

Common Usability Issues & How to Avoid:

3. Poor Error Messages

- **Problem:**
Vague, technical, or unfriendly error messages frustrate users and prevent them from fixing problems.
- **Real-World Example:**
A login page shows: Error 404: Not found
- **How to Avoid:**
 - Write **clear, friendly, and helpful** error messages.
 - Indicate **what went wrong** and **how to fix it**.
 - Highlight errors **near the input field**.

Common Usability Issues & How to Avoid:

4. Lack of Accessibility

- **Problem:**

When systems ignore users with disabilities (visual, motor, cognitive), it becomes unusable or unfair.

- **Real-World Example:**

A website uses **low-contrast text** and **no keyboard support**, making it unreadable for visually impaired users and unusable for those who can't use a mouse.

- **How to Avoid:**

- Use **high color contrast**, readable fonts.
- Ensure screen reader compatibility (e.g., alt text on images).
- Allow **keyboard navigation**.
- Follow **WCAG (Web Content Accessibility Guidelines)**.



Issue

Complex Interfaces

Inconsistent Navigation

Poor Error Messages

Lack of Accessibility

Real-World Example

Overloaded banking app menus

"Add to Cart" vs "Buy Now" confusing buttons

"Error 403: Authentication failed"

Low-contrast website, no keyboard support

How to Avoid It

Use clean design, group features, simplify UI

Consistent layout and naming across pages

Use clear, human-readable messages with solutions

Follow WCAG, use high contrast, support screen readers



Device/System Security

- Device or System Security refers to the **protection of computer systems, mobile devices, and networks** from **unauthorized access, theft, damage, or disruption**.
- It includes both **software** (e.g., firewalls, antivirus) and **hardware** (e.g., biometric locks) defenses.
- **Confidentiality** → Keep it **secret**
- **Integrity** → Keep it **correct**
- **Availability** → Keep it **accessible**

Example: In online banking, your data is encrypted (confidentiality), unchanged (integrity), and the service is up 24/7 (availability).

Principle of Security

Objective	Explanation	Real-Life Example
Confidentiality	Ensuring only authorized users can access data	WhatsApp encrypts your chats so only you and the recipient can read them.
Integrity	Ensuring data is accurate and unchanged	A bank system prevents unauthorized money transfers or account edits.
Availability	Making sure the system is available when needed	Online banking systems have backup servers to prevent downtime.



Digital Signature:

- To ensure the document **hasn't been changed** or tampered with after sending, they use a **digital signature**.
- A **digital signature** is a **mathematical technique** used to validate the **authenticity and integrity** of a digital message or document.

It Ensures:

- **Authenticity** – Confirms the identity of the sender
- **Integrity** – Verifies that the content hasn't changed
- **Non-repudiation** – The sender cannot deny sending it later

Integrity:

- A digital signature is a way to ensure that the content of the email has not been altered after it is sent.

How It Works (Simple Version):

- **Sender signs** a message using their **private key** (from a pair of cryptographic keys).
- The **receiver uses the sender's public key** to verify the signature.
- If the verification passes:
 - The message is **authentic**
 - It **has not been tampered with**

Security Policies and Best Practices:

- Data Protection Policies
- Regular Security Audits
- Employee Training and Awareness
- Incident Response Planning

Homework : Case Studies

- Equifax Data Breach (2017)
- Sony PlayStation Network Breach(2011)
- Yahoo Data Breach (2013-2014)



Device/System Accessibility

Key Aspects



Inclusivity



Adaptability



Compliance

Principles of Accessibility



Perceivability

Information must be presentable to users in ways they can perceive



Operability

Users must be able to operate the interface



Understandability

Users must be able to understand the information



Robustness

Content must be robust enough to be interpreted by a wide range of user agents

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- **Accessibility** means designing devices and systems so that **all users, including those with disabilities**, can use them **effectively and equally**.
- This includes users with:
- Visual impairments
- Hearing difficulties
- Motor challenges
- Cognitive disabilities



Aspect	Explanation	Real-Life Example
Inclusivity	Designing for all types of users , regardless of ability.	A website that works equally well for users with screen readers.
Adaptability	Systems that adjust to users' individual needs or preferences.	A smartphone offering voice control or larger text size options.
Compliance	Following accessibility standards like WCAG guidelines.	Government websites required to meet WCAG 2.1 standards for accessibility.

Web Content Accessibility Guidelines (WCAG)

<https://www.w3.org/TR/WCAG21/>



Principles of Accessibility (POUR Model)

1. Perceivability

- **Users must be able to perceive the information being presented.**

Example:

- Use **alt text** for images so screen readers can describe them.
- Use **high color contrast** so text is readable for colorblind users.

2. Operability

- **Users must be able to interact with the system or interface.**

Example:

- A website that supports **keyboard-only navigation** for users who can't use a mouse.
- Buttons that are large enough to tap for users with motor impairments.

Principles of Accessibility (POUR Model)

3. Understandability

- **Users must be able to understand the content and how to use the system.**

Example:

- Clear, simple language on forms and instructions.
- Consistent navigation so users don't get confused.

4. Robustness

- **Content must be compatible with a wide range of devices and assistive technologies.**

Example:

- A web app that works on **screen readers, voice assistants, and different browsers.**
- A PDF that is tagged correctly so it can be read by accessibility tools.



Principles of Accessibility (POUR Model)



Principle	Description	Real-Life Example
Perceivability	Information must be visible/audible	Alt text, captions, high contrast
Operability	Users must control it easily	Keyboard access, voice control
Understandability	Interface must be clear	Simple forms, consistent UI
Robustness	Compatible with assistive tools	Works with screen readers, multiple platforms





Aspect

Perceivability

Understandability

User Action

Can **notice** content

Can **comprehend** content

Main Concern

Sensory access (seeing, hearing)

Cognitive access (thinking, understanding)

Affected Users

Blind, deaf, low vision

Users with cognitive disabilities, all users

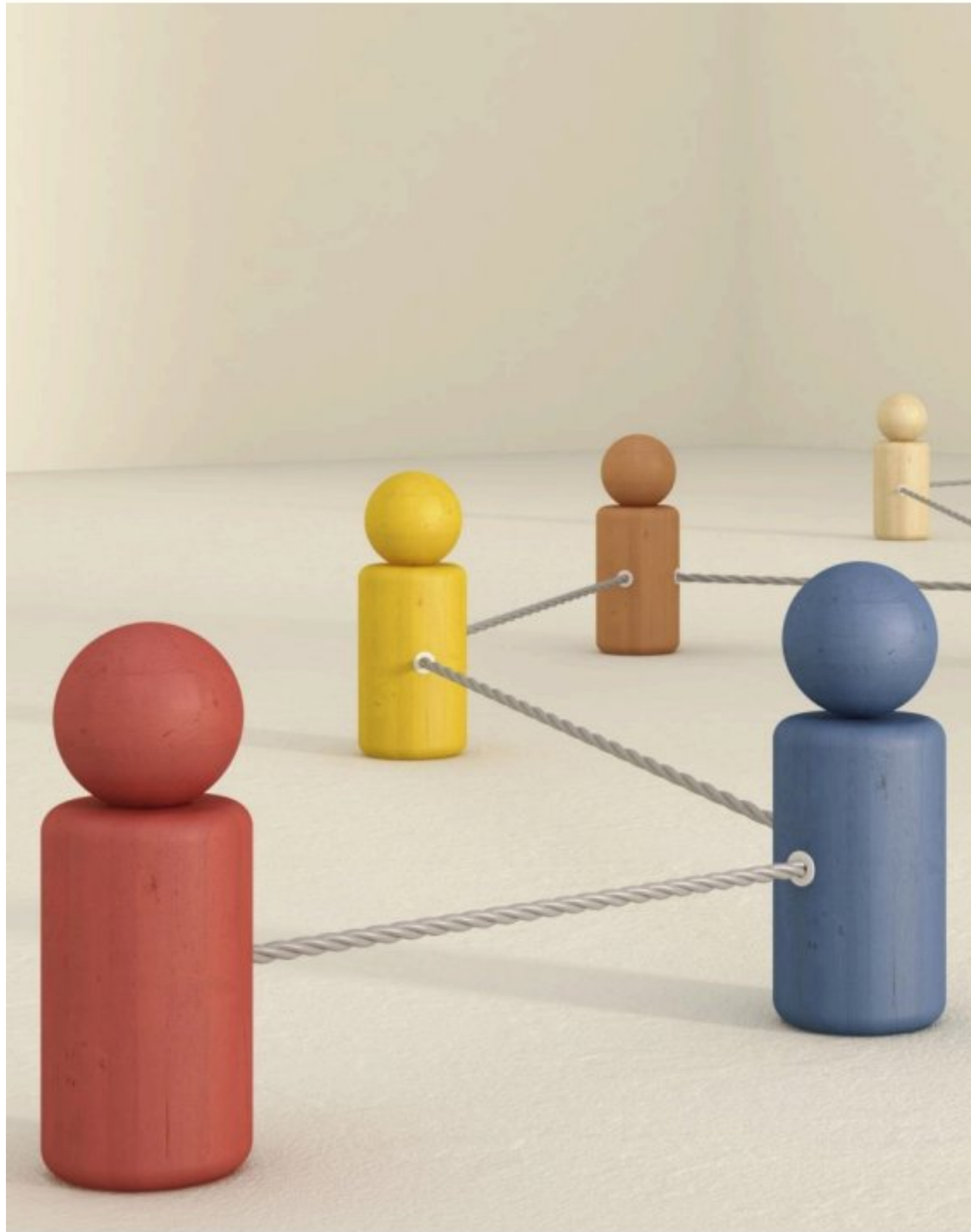
Key Techniques

Alt text, captions, color contrast

Clear instructions, simple language, structure



Disability Type	Description	Accessibility Features / Solutions	Real-Life Example
1. Visual Impairment	Includes partial or complete blindness , or color blindness .	- Screen readers (e.g., NVDA, VoiceOver) - High contrast modes - Alt text for images	A blind user uses a screen reader to navigate a website.
2. Hearing Impairment	Difficulty in hearing or complete deafness.	- Subtitles & closed captions - Visual alerts instead of sounds	YouTube videos with subtitles for deaf users.
3. Motor Impairment	Difficulty in using hands or limbs due to paralysis, or injury.	- Voice control or speech recognition - Switch control systems - Large clickable areas	A person with Parkinson's uses voice commands to control their phone.
4. Cognitive Impairment	Challenges in understanding, memory, learning (e.g., dyslexia,).	- Simple UI - Easy-to-read fonts - Step-by-step navigation	A user with dyslexia uses a website with clean layout and readable fonts.
5. Speech Impairment	Difficulty speaking clearly or at all.	- Text-to-speech - Alternative input systems	A person uses typing instead of voice input for smart assistants.



Accessibility is about designing systems that **remove barriers** for people with **different types of impairments**, ensuring **equal access and usability**.

Human-Computer Interaction (HCI)

- **HCI** is a multidisciplinary field that combines computer science, psychology, design, and ergonomics to create systems and interfaces that are easy to use and understand.
- **Main Components of HCI:**
- **The User:** Human interacting with the system.
- **The Computer:** Any digital device (PC, smartphone, ATM, etc.).
- **The Interaction:** Communication between the user and the computer (via keyboard, mouse, touch, voice, etc.).



Discipline

Computer Science

Psychology

Design (UI/UX)

Cognitive Science

Ergonomics/Human Factors

Linguistics

Contribution to HCI

Software and hardware design, system performance

Understanding human behavior, perception, and cognition

Creating user-friendly interfaces, visual layout, user experience

How users think, learn, and remember while using systems

Physical interaction, comfort, and safety in using devices

Natural language processing and communication patterns



Usability in HCI

Learnability	How easy it is for users to learn to use the system.
Efficiency	How quickly and with how little effort a task can be completed once learned.
Memorability	How easily users can remember how to use the system after a break.
Error Handling	How well the system helps users avoid, detect, and recover from errors.

Mobile Recharge through HBL app vs Bank Al Habib
<https://www.youtube.com/watch?v=2OpgkMN1Xow>
<https://www.youtube.com/watch?v=fTL8rroHOZ0>

Error Handling
<https://www.facebook.com/>

Common problems in Human-Computer Interaction (HCI)

Problem	What It Means	Real-Life Example
Interface Issue	Poor layout/navigation	Hard-to-use mobile app
Accessibility Issue	Not usable for people with disabilities	No screen reader support
Performance Issue	System is slow or crashes	App freezing or lagging
Poor Error Handling	Vague error messages, no guidance	"Transaction failed" with no reason
Lack of Feedback	No response after user action	No message after quiz submission

- <https://www.rankingbyseo.com/blog/bad-websites/>

Methods for improving Human-Computer Interaction (HCI)

- **1. User-Centered Design (UCD)**
- UCD focuses on **designing systems based on the needs, preferences, and limitations of end-users**. It involves collecting feedback through surveys, usability testing, and prototyping throughout the design process.
- **Example:**
A university develops a student portal by **interviewing students** about what features they need most (e.g., grades, timetable, fee status). The interface is adjusted based on their feedback before launch.
- **Impact:** Results in higher user satisfaction and relevance.

2. Accessibility Enhancement

This method ensures that **users with disabilities** (visual, auditory, motor, cognitive) can interact with the system by following standards like **WCAG (Web Content Accessibility Guidelines)**.

- **Example:**
A government website includes:
- **Alt text for images**
- **Keyboard navigation**
- **Text-to-speech support**
- **High-contrast mode** for the visually impaired
- **Impact:** Increases inclusivity and legal compliance.

3. Simplifying the User Interface (UI)

- A simplified interface removes **clutter, unnecessary features, and complex navigation**, making the system more intuitive and faster to use.
- **Example:**
Google's homepage:
 - A simple search bar
 - Minimal distractionsThis clean UI makes it one of the most effective interfaces ever.
- **Impact:** Reduces cognitive load and learning time for new users.

4. Improving System Performance

- Optimizing the speed and responsiveness of the system so that user interactions are **fast, smooth, and reliable**.
- **Example:**
An online shopping app reduces loading time for product images and checkout by using **content delivery networks (CDNs)** and optimized code.
- **Impact:** Improves user retention and satisfaction.

5. Error Prevention and Recovery

- Designing systems to:
- **Prevent users from making mistakes**, and
- **Guide them clearly to recover** if an error happens.
- **Example:**
- **Prevention:** Graying out the “Submit” button until all required fields are filled.
- **Recovery:** If a user uploads the wrong file type, show: “Only .pdf files allowed — please upload again.”
- **Impact:** Reduces frustration, saves time, and improves reliability.

Methods for improving Human-Computer Interaction (HCI)

Method	Description	Example
User-Centered Design	Design based on user needs and feedback	Student portal built from student surveys
Accessibility Enhancement	Inclusive features for disabled users	Screen reader, alt text, high-contrast UI
Simplifying UI	Clean layout, minimal features	Google homepage
Improving Performance	Faster loading and response time	Optimized shopping app
Error Prevention & Recovery	Prevent errors and help users recover gracefully	Validations and helpful error messages

Human-Computer Interaction (HCI)

- **“Implication”** means “what might happen because of something.”
- **Examples:**
- **If a system collects user data without consent,**
 - **Ethical Implication:** It violates user privacy.
- **If a touchscreen interface is hard for older people to use,**
 - **Social Implication:** It excludes certain user groups from accessing services.
- **If a software helps companies automate jobs,**
 - **Economic Implication:** It may reduce job opportunities.
- **If a device uses a lot of energy,**
 - **Environmental Implication:** It increases electricity usage and harms the environment.

Ethical Implications in Human-Computer Interaction (HCI)

- Ethical concerns in HCI relate to **user privacy, data protection, fairness, and digital well-being**.
- **Example:**
A fitness app tracks user health data (like heart rate and location). If this data is **shared without user consent**, it violates **ethical principles** of privacy and trust.

Social Implications in Human-Computer Interaction (HCI)

- These deal with how HCI affects **people, society, and culture.**
- **Key Points:**
- **Digital Divide:** Unequal access to devices and interfaces can worsen social inequality.
- **Changing Communication:** HCI (e.g., smartphones, social media) affects how we interact socially.
- **Community Engagement:** Collaborative systems (e.g., forums, games) affect how people interact socially.

Social Implications in Human-Computer Interaction (HCI)

- HCI affects **how people communicate, interact, and build relationships**. Poor design can lead to **social isolation** or **discrimination**, while good design can foster **inclusion and collaboration**.
- **Example:**
Social media platforms can **connect people worldwide**, but they can also **promote addiction or cyberbullying** due to features like endless scrolling or lack of content moderation.

Economic Implications in Human-Computer Interaction (HCI)

- These relate to how HCI affects **jobs, industries, and financial aspects**.
- **Key Points:**
- **Automation & Job Displacement:** User-friendly systems may replace human roles (e.g., self-checkout kiosks).
- **Increased Productivity:** Better interfaces lead to faster, more efficient work (e.g., CRM software).
- **Cost of Usability:** High usability design may require investment, but poor usability may cost more in support.
- **Global Market Expansion:** Well-designed interfaces (e.g., multilingual apps) enable global product reach.
- **Consumer Behavior Influence:** UI/UX design can affect shopping habits and boost online sales.

Environmental Implications in Human-Computer Interaction (HCI)

- **Technology affects the environment** through things like:
 - **Energy consumption** (how much electricity is used)
 - **Resource use** (materials needed to make devices)
 - **Waste management** (how e-waste is handled)
- **Sustainable practices in HCI** are important to reduce harm to the environment.
 - This means designing technology that **uses less energy**, **creates less waste**, and is **more eco-friendly**.

Environmental Implications in Human-Computer Interaction (HCI)

- "Companies like Google and Microsoft are investing in renewable energy to power their data centers..."
- These companies are using **solar, wind**, instead of fossil fuels.
- Their goal is to **reduce carbon footprint** (pollution that causes climate change).
- This promotes **sustainability**, which means using resources in a way that protects the planet for future generations.



Implication Type	Description	Real-Life Example
Ethical	Data privacy, fairness, transparency	Health app sharing data without consent
Social	Human relationships, inclusion/exclusion	Cyberbullying on social media
Economic	Jobs, business cost, accessibility	Kiosks replacing human cashiers
Environmental	Energy use, e-waste, carbon footprint	Always-on smart device increasing energy bills



Trade-off between Usability and Security

- A **trade-off** means **sacrificing one benefit to gain another**. In security design, improving one factor (e.g., **security**) may reduce another (e.g., **usability**) — and vice versa.

Aspect	Security Measure	Usability Concern	Real-Life Example
Authentication	Enforcing strong passwords or 2FA	Users find it hard to remember complex passwords or go through extra login steps	Logging into a bank app using password + OTP may frustrate users who want quick access.
Access Control	Restricting features based on user roles	Users may feel blocked or unable to access required tools	A student portal limits access to only some resources, but the user may need more.
Encryption	Encrypting files or data transmission	May slow down performance or require decryption steps	Encrypted email attachments require passwords; users may forget them or face delays.
Regular Updates	Frequent patches and updates to fix security flaws	Interruptions, forced reboots, or compatibility issues	A forced iOS update causes some apps to stop working temporarily.

Cybersecurity Recommendation Factors

- **Efficiency**

How well a cybersecurity solution performs without slowing down or disrupting the system.

Example:

- A company uses **firewall and antivirus software** that runs in the background without slowing down employee computers.
- In contrast, a **complex biometric scanner** that takes 30 seconds to recognize a face might protect a system but frustrate users — reducing efficiency.
- **Trade-off:** Sometimes **very secure** tools can slow down systems or annoy users.

Cybersecurity Recommendation Factors

- **Cost**

The financial impact of implementing and maintaining the cybersecurity measure.

Example:

- **Free antivirus software** (like Avast or Windows Defender) is a low-cost option for home users.
- In contrast, **enterprise-level solutions** like Cisco security tools are expensive but suitable for banks and hospitals.
- **Trade-off:** High-end security may be too expensive for small businesses or schools.

Cybersecurity Recommendation Factors

- **Privacy:**
- Whether the cybersecurity measure respects **user data** and doesn't collect unnecessary personal information.

Example:

- **Google Chrome** offers safe browsing, but collects user behavior data — raising privacy concerns.
- A privacy-respecting browser like **Brave** or **DuckDuckGo** may offer less integration but better privacy.
- **Trade-off:** Some tools may improve security but collect too much personal data.

Cybersecurity Recommendation Factors

- **Ethics**

Whether the cybersecurity solution is **fair, transparent, and respects human rights**.

- **Example:**

- **Surveillance software** used by companies to monitor employees may prevent data leaks but raise ethical concerns about privacy and trust.
- **AI-based security tools** must avoid bias — e.g., facial recognition should not wrongly flag certain people more than others.
- **Trade-off:** Ethical concerns arise when security is implemented without consent or transparency.

Cybersecurity Recommendation Factors

Factor	What It Means	Real-World Example	Trade-off
Efficiency	Speed and performance	Fast antivirus that doesn't slow your system	Over-secure tools may cause delays
Cost	Affordability and budget impact	Free vs paid security tools	Higher cost ≠ always practical
Privacy	Protection from unnecessary surveillance	Browsers like Brave vs Chrome	Privacy often vs convenience
Ethics	Moral fairness and human rights	Employee monitoring software	May lead to mistrust