

Course title: Research Methodology in Computer Science

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Subject title: Windows applications using human-computer interaction (HCI)

1-Problem statement:

This research lies within the domain of Human-Computer Interaction (HCI), particularly focusing on usability and user-centered design in desktop software applications. HCI is a discipline that studies the design, evaluation, and implementation of interactive computing systems for human use and the phenomena surrounding them. It combines knowledge from computer science, cognitive psychology, design, and ergonomics to improve how users interact with digital systems.

In the context of this study, the domain specifically targets Windows-based desktop applications, which remain central in enterprise environments despite the rise of mobile and web applications. Ensuring that these applications offer a smooth, intuitive, and satisfying experience is a primary concern of HCI.

2-Research Objectives:

1. To analyze the most common usability issues in existing Windows desktop applications used in enterprise and individual environments.

- This includes identifying patterns of poor UI design, inconsistencies in navigation, and violations of core usability heuristics.

2. To evaluate current applications against HCI principles and usability standards.

- This involves conducting heuristic evaluations and reviewing user feedback on selected applications.

3. To propose redesign strategies and user-centered improvements for selected applications based on HCI models.

- The goal is to suggest changes that enhance task efficiency, minimize user error, and improve user satisfaction.

4. To design a low-fidelity prototype or conceptual framework that incorporates HCI guidelines such as Microsoft's Fluent Design System.

- This would demonstrate how improvements can be integrated practically into existing systems.

5-To investigate the impact of usability improvements on user performance and satisfaction.

- This includes measuring changes in task completion time, error rates, and perceived usability after redesign implementation.

6-To compare the usability of legacy Windows applications before and after applying HCI-based enhancements.

- This comparative evaluation helps quantify the effectiveness of HCI interventions.

7-To assess user expectations and mental models when interacting with desktop interfaces.

- Understanding cognitive patterns supports the design of more intuitive applications.

8- To develop a usability evaluation checklist tailored for Windows desktop applications.

- This checklist can serve as a lightweight tool for developers to identify common usability flaws early in the design cycle.

9-To explore the integration of accessibility principles alongside HCI guidelines in desktop application design.

- Ensuring inclusivity for users with diverse needs and abilities.

10- To identify organizational barriers that hinder the adoption of HCI principles in Windows software development.

- This includes challenges such as budget constraints, legacy systems, or lack of UX training among developers.

3- Problem Description:

While desktop applications are a staple of productivity in workplaces and individual use, many of them still suffer from poor user interface (UI) design and low usability. These issues become more pronounced when applications are developed with minimal consideration of user-centered design principles.

Common problems include:

- Inconsistent or confusing navigation structures.
- Overloaded or poorly organized screens.
- Lack of immediate feedback for user actions.
- Non-intuitive labels, icons, or workflows.

According to (Nielsen, 1994) Usability problems often arise when developers neglect core heuristics such as visibility of system status, consistency, error prevention, and user control. These flaws in design negatively impact the user experience (UX) by increasing task completion time, user frustration, and the likelihood of user errors, Shneiderman, B., & Plaisant, C. (2010).

In particular, Windows desktop applications—especially legacy or internally developed ones—often lack adherence to modern HCI standards due to limited design resources or outdated development practices. Users may encounter steep learning curves, inaccessible layouts, or interfaces that do not align with their mental models, which contradicts HCI's primary goal of supporting efficient, effective, and satisfying user interaction. ISO 9241-11.(2018)

Thus, the problem this study addresses is the lack of systematic usability evaluation and HCI-based redesign in widely used Windows desktop applications. By identifying and analyzing these usability issues, the study aims to propose and prototype improvements that align with modern HCI principles, leading to better user satisfaction and improved task performance.

4- Significance of the Problem :

Usability and user experience are critical factors that directly affect the efficiency, satisfaction, and productivity of users when interacting with software systems. In enterprise settings where Windows desktop applications are still widely used for data entry, reporting, and management tasks, poor interface design can result in operational inefficiencies, increased training costs, and user frustration. For example, if a system lacks intuitive navigation or provides poor visual feedback, users may commit errors that lead to delays or even financial loss .

From a Human-Computer Interaction perspective, neglecting usability in desktop software undermines the goals of user-centered design, which emphasize building systems that align with users' cognitive models, expectations, and tasks (Norman ,2013). Improving the usability of these applications is not just about aesthetics; it also has real-world impacts on task performance, error rates, and user satisfaction (ISO 9241-11.(2018) .

Additionally, as more organizations shift to digital transformation, improving legacy desktop applications with HCI principles becomes an important strategy to extend their lifecycle while boosting overall user experience without complete system replacement.

5-Existing Solutions :

There have been several approaches to address usability issues in software applications:

1- Heuristic Evaluation

One of the most widely used techniques is heuristic evaluation, where experts assess a user interface based on predefined usability principles (Nielsen, 1994). While helpful, this method often lacks real user feedback and may not catch all issues.

2- Usability Testing with Users

Conducting usability tests with real users allows developers to observe pain points directly and adjust designs accordingly. However, this process is time-consuming and resource-intensive, especially in smaller organizations.

3- UI Design Guidelines by Microsoft

Microsoft provides detailed UI/UX design guidelines for Windows desktop apps, such as those found in the Fluent Design System. These guidelines help standardize design practices, but many legacy applications were developed before these frameworks existed—or without fully implementing them.

4- UX Design Tools and Platforms

Tools like Figma, Adobe XD, and Axure help designers prototype and test UI designs more easily. However, applying these tools to already-developed applications often requires redevelopment, which can be costly .

Despite the availability of these tools and methods, many applications in real-world use still suffer from poor usability due to lack of awareness, budget constraints, or resistance to redesign. This highlights the need for structured research to analyze existing issues and propose practical, affordable improvements based on HCI best practices .

6-Justification for the Study: Despite the availability of usability principles and interface design guidelines, many Windows desktop applications continue to suffer from poor user experience, especially in enterprise environments where older systems are still in use. These systems are often designed with a function-first approach, prioritizing backend logic over user interaction and comfort.

As Norman (2013) argues , a usable design is not only about how a system functions, but also about how it fits “ into the lives and cognitive processes of the people using it.” This statement emphasizes the need to consider psychological and behavioral factors when designing interfaces, particularly for frequent-use software like desktop applications.

Furthermore, while tools such as heuristic evaluation and usability testing exist, they are underutilized in real-world development workflows due to constraints like budget, time, or lack of UX expertise(Nielsen ,1994). This gap between theoretical frameworks and practical implementation forms the core motivation for this research.

Additionally, ISO 9241-11. (2018). highlights that improving usability is not optional but essential, defining it as “the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction.” In line with this, enhancing existing systems using HCI principles provides a cost-effective alternative to complete system redevelopment.

By identifying usability flaws in commonly used desktop applications and proposing improvements grounded in HCI best practices, this research can help bridge the gap between academic usability models and real-world application design, offering practical benefits to users and developers alike.

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