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Heuristic Evaluation of the MOBIMAL Mobile Banking Application: A Case Study of the National Commercial Bank of Libya

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ABSTRACT

Mobile banking applications have become an important platform for delivering financial services. However, the limited screen size and interaction capabilities of mobile devices make designing usable mobile applications particularly challenging. This study evaluates the usability of MOBIMAL (versions 4.0.1 and 4.3.0), the mobile banking application of the Libyan National Commercial Bank, using Nielsen's ten usability heuristics. A qualitative case study design based on heuristic evaluation was adopted. The evaluation examined six representative banking tasks covering the application's core functionalities to identify usability problems affecting the user interface. The evaluation identified multiple usability problems related to system visibility, consistency, interaction flow, error prevention, and user control, and practical design recommendations were proposed to improve the application's usability. To enhance the credibility of the findings, the identified usability problems were subsequently reviewed by four independent external evaluators with backgrounds in Human–Computer Interaction (HCI), User Experience (UX), and mobile application development, who independently assigned severity ratings using Nielsen's severity rating scale. The findings demonstrate that heuristic evaluation provides a practical and systematic approach for identifying usability problems and supporting the development of more user-centered mobile banking applications.

1. Introduction

Given the low cost, increasing computational power, and ease of use, mobile devices have become the primary platform for accessing digital services worldwide. This trend is also evident in Libya, where mobile connectivity and internet usage have reached high levels. According to DataReportal (2025), based on data from GSMA Intelligence, Libya recorded approximately 14.9 million mobile cellular connections by the end of 2025, equivalent to 199% of the total population, reflecting the widespread use of multiple SIM subscriptions among individuals. During the same period, approximately 6.62 million individuals were using the Internet, representing an Internet penetration rate of 88.5%. This widespread digital connectivity has facilitated the adoption of various mobile applications, including mobile banking, which has become a major e-services delivery platform for most Libyan banks. Nevertheless, the adoption of online services continues to be influenced by social and behavioral factors, such as customers' trust and attitudes toward conducting business online. Previous studies have reported that users in some Middle Eastern countries tend to prefer traditional and more personal forms of communication, making them relatively less

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confident in conducting business transactions through information technology (Al Hosni et al., 2010). This poses a significant challenge for online service providers.

In addition to these non-technical challenges, technical issues such as software usability can also discourage the adoption of mobile banking services. In the context of mobile applications, usability is even more critical than in desktop applications because mobile devices are inherently constrained by limited screen size and input capabilities, making the design of user-friendly mobile applications particularly challenging (BuddeComm, 2021).

Despite the widespread adoption of mobile banking services, ensuring the usability of mobile banking applications remains essential for supporting efficient, effective, and user-centered financial services. Systematic usability evaluation provides a structured approach for identifying interface design issues that may negatively affect users' interaction and overall experience. Therefore, this study aims to evaluate the usability of the MOBIMAL mobile banking application using Nielsen's ten usability heuristics to identify usability problems and derive practical design recommendations for improving the application's usability.

Accordingly, this study addresses the following research questions:

RQ1: What usability problems can be identified in the MOBIMAL mobile banking application using Nielsen's ten usability heuristics?

RQ2: What design recommendations can be derived from the identified usability problems to improve the usability of the MOBIMAL mobile banking application?

2. RELATED WORK AND BACKGROUND

Online Banking

Online banking is one of the most widely adopted digital banking services, providing customers with convenient access to financial services such as balance inquiries, fund transfers, and electronic payments. Besides improving customer convenience, online banking reduces operational costs and enables financial institutions to deliver services regardless of geographical constraints, making financial services more accessible to geographically dispersed populations (Osei et al., 2023; Tuli, 2024). This capability is particularly important in geographically large countries such as Libya, where establishing physical bank branches in remote areas is often economically impractical. Despite the availability of mobile banking services offered by several Libyan banks, many customers continue to rely on conventional banking due to organizational, technical, and usability-related challenges (Rusu et al., 2016).

Usability of Interactive Systems

Usability is an essential software quality attribute that reflects how effectively, efficiently, and satisfactorily users can interact with software systems. Common usability attributes include learnability, efficiency, memorability, errors, and user satisfaction (De Kock et al., 2009). Usability evaluation methods are generally classified into user-based and expert-based approaches. Although user-based evaluation provides valuable insights into users' experiences, it is often time-consuming, costly, and difficult to organize. Consequently, this study adopts an expert-based approach, specifically heuristic evaluation, because it provides a practical, systematic, and cost-effective means of identifying usability problems during interface evaluation (Malhotra & Singh, 2010; Kumar & Hussein, 2014).

Heuristic Evaluation and Previous Studies

Heuristic evaluation has become one of the most widely used expert-based usability inspection methods because it enables evaluators to identify interface problems efficiently without requiring large numbers of end users. Owing to its practicality and relatively low cost, it has been extensively applied to evaluate mobile

applications across different domains, particularly financial applications.

Several studies have successfully applied heuristic evaluation to mobile banking and digital financial applications. For instance, an overall task completion rate of 83% and a System Usability Scale (SUS) score of 77 were reported when heuristic evaluation was combined with usability testing to evaluate mobile banking applications, while identifying several usability issues requiring interface improvements (Malik et al., 2021). Similarly, evaluating the usability of mobile payment applications using heuristic evaluation together with usability testing revealed 63 usability problems, including 30 major problems, with most violations related to Help and Documentation and User Control and Freedom (Ali et al., 2022). Meanwhile, usability testing in the same context demonstrated satisfactory performance in learnability, efficiency, memorability, error handling, and user satisfaction. Collectively, these studies demonstrate that heuristic evaluation effectively complements user-based evaluation by revealing interface design problems that may not be fully reflected through user performance measures alone.

More recent studies further support the applicability of heuristic evaluation to financial applications. Evaluating the UI/UX of digital financial applications using heuristic evaluation supported by user reviews and interviews showed that heuristic evaluation effectively identified recurring usability problems related to Recognition Rather than Recall, Error Prevention, and Flexibility and Efficiency of Use (Piisi & Kristianto, 2025). Likewise, evaluating cooperative mobile applications using Nielsen's ten usability heuristics confirmed that heuristic evaluation provides an effective approach for identifying usability issues and guiding interface improvements, particularly those related to Help and Documentation (Zaelani & Banowosari, 2025).

The applicability of heuristic evaluation extends beyond financial systems. Nielsen's heuristics were applied to evaluate the usability of academic portals to propose several recommendations for interface enhancement (Al-Dossari, 2017). Furthermore, incorporating heuristic evaluation into the design and assessment of an ecotourism smartphone application resulted in identifying 22 catastrophic, 4 major, and 12 minor usability problems, thereby demonstrating the value of integrating heuristic evaluation during the application development process (Ganapathy et al., 2021). Similarly, combining heuristic evaluation with cognitive walkthrough to evaluate mobile applications identified usability problems affecting the profile menu, learnability, and interaction efficiency, leading to several interface improvement recommendations (Fitria, 2024). Although previous studies consistently demonstrate the effectiveness of heuristic evaluation for identifying usability problems, they also indicate that the nature and severity of usability issues vary according to an application's interface design, functionality, and interaction workflow. Consequently, usability findings cannot be directly generalized across different applications. To address this need, the present study evaluates the usability of the MOBIMAL mobile banking application using Nielsen's ten usability heuristics and derives practical design recommendations based on the identified usability problems.

3. Methodology

This study adopted a qualitative case study design based on heuristic evaluation. The evaluation was conducted on MOBIMAL versions 4.3.0 and 4.0.1, running on the Android operating system. Several qualitative data collection methods were employed in this study. First, the researcher conducted a heuristic evaluation of the preselected MOBIMAL tasks presented in Table 1.

Table 1: MOBIMAL tasks selected for the evaluation

#	Task
1	Log in to the app
2	Display bank statement

3	Buy prepaid cards
4	Transfer money to another account
5	Purchase using 'Yosser Pay' service
6	Inquire about the steps to cancel a cheque

The selected tasks represent the core banking functions available in the application and were chosen to provide broad coverage of its primary functionalities. To enhance the credibility of the heuristic evaluation findings, four independent external evaluators were purposively selected based on their academic or professional backgrounds relevant to Human–Computer Interaction (HCI), User Experience (UX), and mobile application development. The evaluators included two MSc graduates from Sebha University who had successfully completed a Human–Computer Interaction course, one mobile application developer with experience developing mobile applications, and one User Experience (UX) designer. None of the evaluators had any involvement in the development of the MOBIMAL application or any conflicts of interest related to this study.

Each evaluator received a copy of the heuristic evaluation report and independently reviewed the corresponding application screens together with the identified usability problems according to Nielsen's ten usability heuristics. The evaluators indicated whether they agreed with each identified usability problem and independently assigned a severity rating using Nielsen's severity rating scale (Table 2). The assigned severity ratings were used to prioritize the identified usability problems according to their relative impact on usability.

It should be noted that the identification of usability problems was based solely on the heuristic evaluation conducted by the researcher. The role of the external evaluators was limited to validating the identified usability problems and assigning severity ratings; detailed analyses of evaluator agreement and severity ratings are beyond the scope of the present paper.

Finally, each evaluator participated in an individual semi-structured interview to discuss cases where differences in severity ratings were observed. The interviews focused on the reasons behind differences in severity ratings and the evaluators' justification for their assessments. Notes were taken during the interviews, and the responses were qualitatively reviewed to support the interpretation of the severity assessments.

All external evaluators participated voluntarily. The purpose of the study was explained to all participants, and informed consent was obtained prior to the validation process and follow-up interviews. The collected information was used solely for research purposes.

Table 2: Severity Rating Scale in Heuristic Evaluation (adapted from Nielsen and Molich, 1990)

0	I don't agree that this is a usability problem at all.
1	Cosmetic problem only: need not be fixed unless extra time is available for the project.
2	Minor usability problem: fixing this should be given low priority.
3	Major usability problem: important to fix, so should be given high priority.
4	Usability catastrophe: imperative to fix this before product can be released.

4. RESULTS AND FINDINGS

The following sections present the usability flaws discovered during heuristic analysis of the MOBIMAL interface. Samples of usability violations were shown in the form of screen dumps.

Multiple usability problems were identified across Nielsen's ten usability heuristics. The following sections present representative examples of the identified usability issues together with illustrative screenshots.

4.1 Visibility of system status

According to Nielsen's visibility of system status heuristic, users should always receive appropriate and timely feedback about the system's current state.

During operations requiring extended processing time, particularly under heavy network or server load, the application displays only a generic

loading indicator accompanied by a "Please wait" message. However, when processing exceeds approximately 20 seconds, the interface provides no indication of the operation's progress or estimated completion. As illustrated in Fig. 1, users receive no information about whether the operation is progressing normally or how much longer they are expected to wait. Providing a progress indicator or periodic status updates during prolonged operations would improve users' awareness of the system status and reduce uncertainty during waiting periods.

Fig. 1: Lack of system status feedback during a long-running operation.

4.2 Match between system and the real world

The underlying principle of this heuristic is that interactive systems should speak the users' language. This includes using familiar terminology and symbolic images, such as icons that are easily recognizable and meaningful to users. In the case of MOBIMAL, non-symbolic icons are used to label different types of transactions. In fact, some interface icons do not clearly represent the banking functions they are intended to perform. Fig. 2 shows a screenshot of a bank statement in which the same icon is used to symbolize both debit and credit transactions, making it difficult for users to

Fig. 2: The same non-symbolic icons are used to label different types of transactions.

distinguish between these two different financial operations. It would be more appropriate to use meaningful and function-specific icons to improve users' understanding of the interface. In addition, MOBIMAL designers were influenced by stereotypical symbols denoting certain tasks. Referring to Table 3, the application uses an image of the famous U.S. Treasury building to denote the Financial Operations task. The use of a locally meaningful symbolic image would be more appropriate for Libyan customers.

Table 3: Duplicate use of similar icons to denote different tasks.

Icon	Denotation
	• Local cards • International cards
	• Proof of Account Letter • Stop a check
	• Display bank statement • Display Prepaid cards • Request a service • Report of requests
	• Debit Note • Credit Note
	• Money transfer • Change Password
	• Current Account • Financial operations

4.3 Consistency and standards

According to Nielsen's consistency and standards heuristic, users should not have to wonder whether different words, situations, or interface elements mean the same thing (Khajouei et al., 2017). In MOBIMAL, this heuristic was violated in multiple ways. As shown in Fig. 3, inconsistencies were observed in the use of interface icons, making it more difficult for users to distinguish between different banking functions and increasing the likelihood of confusion. Although this does not represent a direct violation of Nielsen's consistency heuristic, providing multilingual support could improve accessibility if the application is intended to serve users with different language backgrounds. Another consistency issue was identified in the interaction flow. Within MOBIMAL, the confirmation button for most data-entry tasks is consistently positioned adjacent to or directly beneath the input area (see Fig. 4). However, the Money Transfer function deviates from this established interaction pattern by requiring a three-step workflow instead of the two-step process used elsewhere in the application (see Fig. 5). Such inconsistency requires users to adapt to a different interaction sequence for a familiar task, increasing cognitive load and the likelihood of user errors.

Fig. 3: Repeated use of similar icons across distinct application

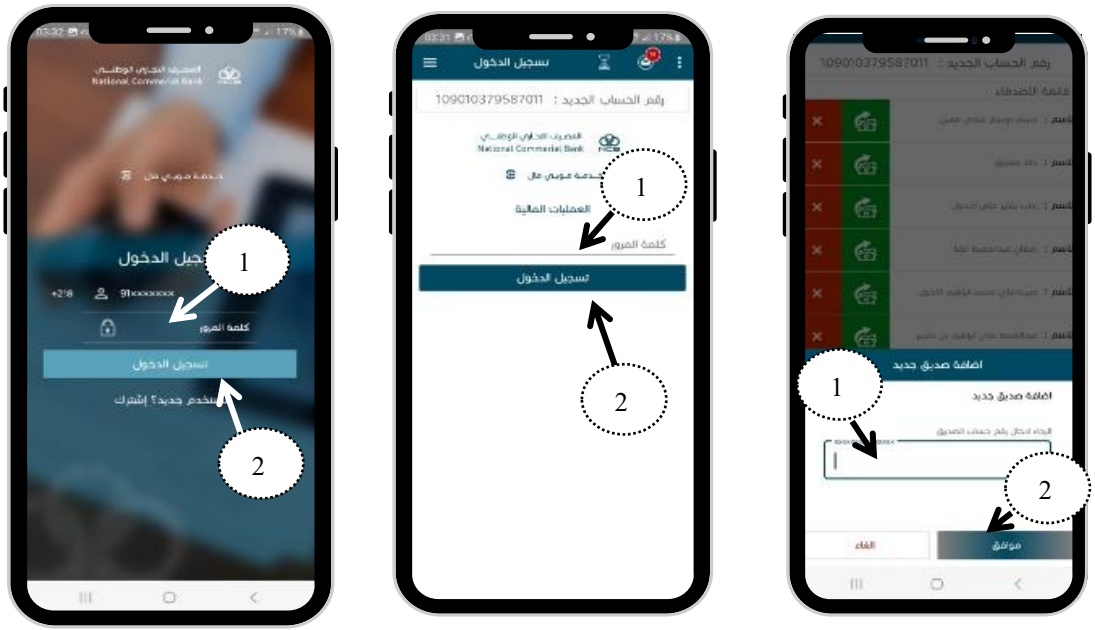

Fig. 4: Two-step confirmation of data entry

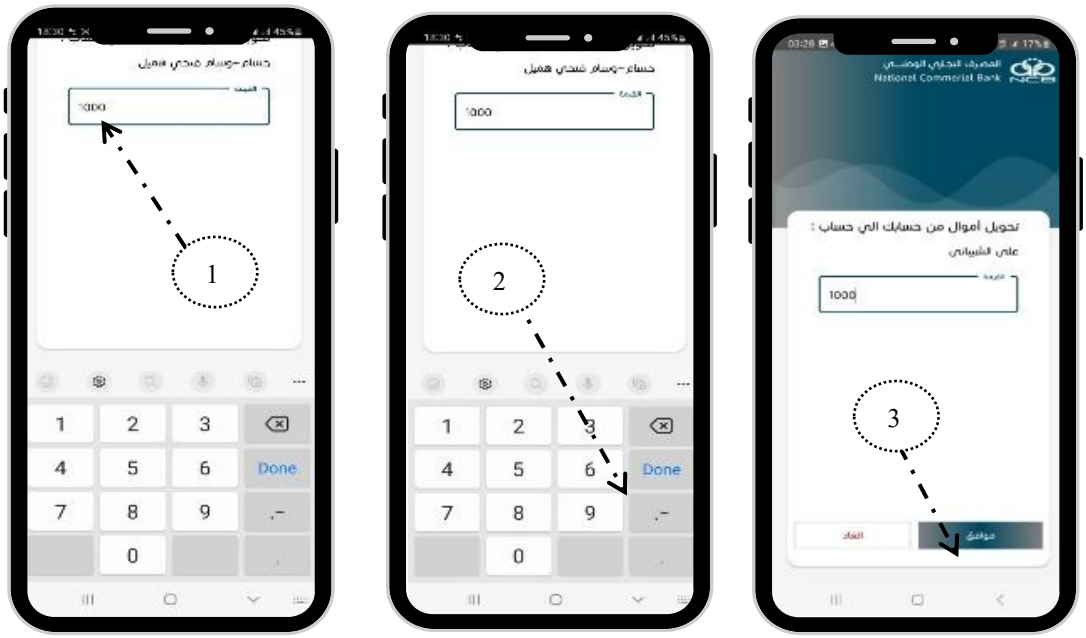

Fig. 5: A three-step confirmation of data entry

4.4 Error prevention

While providing clear error messages is a necessary usability heuristic, a more fundamental principle is proactive error prevention—designing interfaces that obviate the conditions under which errors occur (Nishchyk et al., 2025). This approach prioritizes reducing cognitive load and minimizing manual data entry, for instance, by replacing free typing with selection from predefined options and by validating entered data. In MOBIMAL, several design choices violate this principle. During login, the application fails to provide a password preview mechanism, which exacerbates the risk of mistyping and of denying access to authorized users. Additionally, when selecting a date range for tasks such as issuing a bank statement, MOBIMAL does not validate the period specified; users can inadvertently select a later (future) date without any warning.

Another source of preventable error lies in the customer authentication process. MOBIMAL generates an SMS-based OTP that appears briefly at the top of the screen before disappearing, forcing users to memorize a six-digit code. This imposes high cognitive load, leading to frequent incorrect recall and repeated OTP requests, which interrupt task flow. Short-term memory capacity is reduced when users try to remember isolated digits or letters (Pribeanu, 2009); chunking the OTP (e.g., 99-99-99) would help. However, a more feasible solution is to auto-fill the OTP instead of requiring manual typing.

4.5 Recognition rather than recall

A core principle of user interface design is to favor recognition over recall, typically through clear, consistent, and familiar icons and labels (Rotaru et al., 2026). However, the MOBIMAL application violates this principle by using identical icons for disparate functions. For instance, within the "Bank Statement" printing task, a single icon ( ) represents both debit and credit transactions, creating ambiguity. As a result, users struggle to identify a particular money transfer transaction within a statement that contains both types of entries. Using distinct symbolic icons for debits and credits would significantly ease this recognition task.

Systems should also minimize memory demands by avoiding arbitrary memorization of multiple PINs or passwords (Mirkowicz & Grodner, 2018). The MOBIMAL multi-level authentication protocol, designed for securing sensitive transactions such as money transfers, violates this principle. It requires users to recall

and input a distinct secondary password, thereby introducing an extra authentication step following the initial login. This reliance on recall rather than recognition increases cognitive load and the risk of user error.

Fig.6: A long Menu that violates the Heuristic

4.6 Flexibility and efficiency of use

According to this heuristic, interactive systems should accommodate both novice and expert users by offering flexible interaction paths and accelerators that speed up frequent tasks. In the context of e-banking, this principle is typically operationalized through features such as scheduled (recurring) transfers, which allow users to set up automatic monthly payments to the same beneficiary (e.g., for a child's allowance or rent). The application under examination, MOBIMAL, completely lacks this capability. Users must manually initiate the same transfer every month, forcing reliance on memory and repetitive effort. This omission directly violates the flexibility and efficiency heuristic, as the system provides no accelerator for a common, repetitive financial task.

Furthermore, system flexibility is often enhanced by supporting expert users with shortcuts or hotkeys. MOBIMAL offers no such accelerators. Another dimension of flexibility is the provision of a multilingual interface to cater to a diverse user base. MOBIMAL lacks this feature for non-Arabic-speaking users, a significant barrier for expatriate workers in Libya, hindering their seamless use of the application. Collectively, these deficiencies demonstrate that MOBIMAL fails to prioritize flexibility and efficiency, instead imposing unnecessary cognitive and temporal costs on its users.

4.7 Aesthetic and minimalist design

Due to the limited screen size of mobile devices (compared to desktop applications), designers of mobile apps should avoid exhausting users with information-dense screens containing too much information or too many choices (Bawden & Robinson, 2020). Designers should instead rely on visual information and cascading (nested) menus. Fig. 6 illustrates a long vertical menu in MOBIMAL that requires redesign. A more appropriate solution would be a two-level nested menu in which related options are grouped together.

A preferable solution would be a two-level nested menu in which certain choices are grouped. Furthermore, matrix-shaped menus (e.g., a grid of icons with labels) would allow users to see multiple options without scrolling up and down, reducing cognitive load. By using long scrollable menus instead of compact or hierarchical layouts, MOBIMAL violates the aesthetic and minimalist design heuristic.

4.8 User control and freedom

User control and freedom imply that users should be able to interrupt ongoing operations, recover from mistakes, and reverse unintended actions through mechanisms such as Undo, Redo, or Cancel (Rotaru et al., 2026). MOBIMAL violates this heuristic in several ways. As previously illustrated in Fig. 1, when poor internet connectivity or server delays occur, the application remains in a prolonged waiting state without providing users with any option to cancel, dismiss, or exit the operation. Consequently, users become trapped in an unresponsive interface with no means of regaining control over the interaction.

Furthermore, MOBIMAL does not provide users with an opportunity to review or cancel a money transfer before final submission. Once the transaction is confirmed, it is processed immediately without an intermediate confirmation step. Providing users with a review and confirmation stage before executing the transaction would help prevent errors and better support user control and freedom. Overall, these findings indicate that MOBIMAL provides limited support for user control and freedom, particularly in situations where users need to interrupt ongoing operations or recover from unintended actions.

4.9 Help and documentation

Regarding help and documentation, an interactive system should provide help when needed (Khajouei et al., 2017). It is recommended that help information should be included on the device. If not, the documentation should be available on a website and/or in printed form (Rusu et al., 2016). MOBIMAL does not provide help information through the app; it is only available on the developer's website.

The identified usability problems were distributed across Nielsen's ten usability heuristics, with varying levels of impact on the overall usability of the application. The representative examples presented in this section illustrate the most relevant findings identified during the heuristic evaluation.

5. Discussion

The heuristic evaluation identified usability problems affecting several core functionalities of the MOBIMAL mobile banking application, including account management, money transfers, transaction history, and service requests. These functions represent the primary services offered by the application; therefore, usability deficiencies within these tasks may negatively influence users' efficiency, confidence, and overall interaction experience. The identified problems were not confined to a single usability principle but were distributed across multiple Nielsen heuristics, indicating that the observed issues were primarily related to interface design and interaction mechanisms rather than isolated implementation errors.

The results revealed recurring usability issues associated with interface consistency, icon interpretation, system feedback during prolonged operations, error prevention, and user control. These findings indicate that improving interface design can substantially enhance the application's usability without requiring changes to its core banking functionality. Furthermore, they highlight several interface areas that should be prioritized for improvement, particularly interface consistency, system feedback, navigation support, and error prevention mechanisms.

These findings are consistent with previous studies that have demonstrated the effectiveness of heuristic evaluation in identifying usability problems in financial applications (Malik et al., 2021; Ali et al., 2022; Piisi & Kristianto, 2025; Zaelani & Banowosari, 2025). Similar to these studies, the present evaluation showed that many usability issues originate from interface design decisions rather than functional deficiencies. However, the specific usability problems identified in the MOBIMAL application differ from those reported in previous work, highlighting that usability findings are application-specific and should therefore be evaluated within the context of each mobile banking application.

While this study primarily focused on usability evaluation, it is important to acknowledge that mobile banking applications operate in a security-critical environment where usability and security must be carefully balanced. Certain interface characteristics, such as additional authentication or verification procedures, may intentionally reflect security requirements designed to protect users and financial transactions. Nevertheless, several of the usability issues identified in this study—including interface inconsistency, insufficient system feedback, unclear interface icons, and limited user control—can be addressed without compromising application security. Future research could further investigate the trade-off between usability and security by combining heuristic evaluation with user-based usability

testing and security-focused usability assessment methods.

Overall, the heuristic evaluation facilitated the development of several practical design recommendations for improving the MOBIMAL mobile banking application. These recommendations include enhancing system feedback during prolonged operations, replacing ambiguous interface icons with clear and contextually appropriate symbols, standardizing interaction workflows, strengthening error prevention mechanisms, reducing users' cognitive and memory load, providing more flexible interaction options, simplifying the application's menu structure, improving user control prior to transaction submission, and integrating comprehensive help and documentation within the application. Collectively, these recommendations provide practical guidance for improving the application's usability, efficiency, and overall user experience while aligning its interface with established usability principles.

5. Conclusion

This study evaluated the usability of the MOBIMAL mobile banking application using Nielsen's ten usability heuristics. The evaluation identified several usability problems affecting interface design, navigation, interaction flow, system feedback, consistency, error prevention, and user control. These findings indicate that even well-established mobile banking applications can contain usability issues that may negatively affect users' efficiency, confidence, and overall experience.

Beyond evaluating a single application, this study demonstrates the value of heuristic evaluation as a practical and systematic approach for identifying usability problems in mobile banking systems. The findings provide design recommendations that may assist developers in improving the usability of similar mobile banking applications and support the development of more user-centered digital financial services. Future research may extend this work by integrating heuristic evaluation with user-based usability testing and applying this approach to other mobile banking applications across different contexts. Such efforts may contribute to the development of more usable, effective, and user-centered mobile banking applications.

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