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Implementation of Prototyping in AI-Based Job Portal Development to Improve User Experience

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Abstract

The rapid development of digital technology has significantly changed the recruitment system, particularly through the emergence of AI-based job portals. However, many systems still fail to meet user expectations due to a lack of user involvement early on in the development process. This study aims to analyze the implementation of prototyping in the development of AI-based job portals to improve user experience and system effectiveness. This research adopts a design-based research approach, using user needs analysis, prototype development, and iterative evaluation. Prototyping is carried out through several stages, including low-fidelity and high-fidelity models, to ensure the usability and functionality of the system. The findings show that prototyping allows for early validation, reduces development risk, and improves user satisfaction through continuous feedback integration. Additionally, artificial intelligence integration supports personalization and improves job matching accuracy. The study concludes that prototyping plays an important role in developing a user-centric digital platform and significantly contributes to improving the quality of the system and user experience. Further research is recommended to explore AI-based prototyping for more adaptive and intelligent system design.

Keywords: prototyping; user experience; job portal; artificial intelligence; human-centered design

INTRODUCTION

The major transformation in today's modern recruitment system is greatly driven by the rapid development of digital technology. AI-based job portal platforms are emerging as a key solution to improve the efficiency of the matching process between candidates and vacancies. However, many systems still fail to meet expectations due to a lack of design validation in the early stages of development. The global online recruitment market has experienced substantial growth, with AI-based hiring platforms accounting for a significant and rapidly expanding share of recruitment activities worldwide. AI capabilities such as semantic skill matching, knowledge graph integration, and personalized job recommendations have demonstrated measurable improvements in matching accuracy and recruiter efficiency. Concurrently, prototyping has been established as an effective design strategy for iterative system development, enabling early-stage validation of interfaces across multiple fidelity levels.

Despite the parallel maturation of prototyping methodology and AI-based recruitment systems, no unified framework currently integrates model-informed prototyping with human-centered design principles specifically for AI-driven job portal development. Prior studies have examined prototyping, human-centered AI (HCAI), and AI-based job matching as separate research streams, without addressing how the behavioral outputs of AI models should directly inform iterative prototype refinement. Empirical studies evaluating the relationship between AI feature complexity and user cognitive load within prototyped recruitment systems remain scarce.

AI-based recruitment systems frequently suffer from usability failures attributable to insufficient user involvement during the design phase. Research indicates that a substantial proportion of UX design failures in AI-powered platforms stems from the opacity of AI processes and the absence of iterative user validation mechanisms. These failures carry significant consequences including reduced user adoption, diminished trust in algorithmic recommendations, and lower system effectiveness. Addressing this gap is therefore critical for the advancement of user-centered AI systems in the digital labor market.

This study addresses the identified gap by proposing and empirically evaluating a model-informed prototyping framework that integrates prototyping methodology, human-centered design (HCD), and AI capabilities within a unified design-based research (DBR) cycle. The primary novelty lies in the operationalization of AI model behavior as a direct input to prototype iteration, enabling development teams to evaluate functional accuracy and experiential quality simultaneously. This framework constitutes a theoretically grounded and practically validated contribution to user experience design for AI-based digital platforms (Kitichalermkiat et al., 2022)(Vyas et al., 2026)(Zhukova et al., 2024).

Use of the approach *Prototyping* It is considered crucial because it allows for repeated testing of the system to minimize the risk of interface design errors. Concept *human-centered design* (HCD) also emphasized that user engagement from the initial phase is critical to ensuring the security and convenience of digital services. In today's industrial era, a UX 3.0 paradigm has emerged that unites artificial intelligence with an innovation ecosystem in user experience design (Subhiyakto & Astuti, 2023)(Harte et al., 2017)(Zhukova et al., 2024).

Prototyping is a development method that allows the creation of an initial model to be tested before the full implementation stage is carried out. In the context of AI, *Prototyping* helps bridge the technical complexity of machines with human interaction experiences, allowing designers to identify model failure points directly. Use of various levels of fidelity, ranging from *Low-Fidelity* up to *High-fidelity*, is very effective in assisting designers in identifying cognitive biases early on (Yanfi & Nusantara, 2022)(Subramonyam et al., 2022)(Katsumata Shah et al., 2023).

Human-Centered Design (HCD) focuses on placing user characteristics at the core of the entire application development process. This approach has now transformed into *Human-Centered AI* (HCAI), which aims to create an automated system while still providing full control and transparency to its users. The three-phase HCD methodology consisting of context analysis, expert inspection, and user testing has proven effective in improving product usability (Subhiyakto & Astuti, 2023)(Tibdewal et al., 2018)(Harte et al., 2017).

AI integration can improve *User Experience* significantly through the application of more in-depth interaction personalization techniques. On job portal systems, AI often utilizes *Knowledge Graphs* to understand the synonyms of the candidate's skills so that the matching results are more accurate. The use of LLMs such as ChatGPT has also proven to be very helpful for practitioners in accelerating the process of comprehensive design ideation (Anand, 2021)(Vyas et al., 2026)(Zhu et al., 2024).

Previous research has generally discussed *Prototyping*, AI, and *User Experience* separately without a single unified framework. *Prototyping* often only focused on design visualization without integrating the technical capabilities of the AI model in depth. Therefore, this study integrates these three aspects through workflows *model-informed prototyping* for design validation based on real behavior of artificial intelligence (Lu et al., 2024)(Subramonyam et al., 2022).

Critically synthesizing the reviewed literature, three converging insights emerge that collectively motivate the present study. First, while prototyping has proven effective in reducing design risk across multiple domains, its application within AI-powered systems has been predominantly confined to interface-level visualization, leaving the behavioral dimension of AI models largely untested during the design phase. Second, HCD and HCAI frameworks consistently emphasize the centrality of user control and transparency, yet empirical implementations in AI job portal contexts remain limited, leaving a significant gap between theoretical advocacy and applied evidence. Third, existing AI-based job matching systems demonstrate strong algorithmic performance, but their usability and interaction design are rarely validated through structured iterative processes involving real users before deployment. Taken together, these gaps justify the need for an integrated, empirically evaluated framework one that positions prototyping not merely as a design tool, but as an active mediator between AI model behavior and user experience optimization.

RESEARCH METHOD

This study uses the *Design-based research* (DBR) with the *User-Centered Design* (UCD) that focuses on developing and evaluating solutions iteratively in a real-world context. This approach was chosen because it is able to integrate the design, implementation, and evaluation processes in one continuous cycle to ensure the usability of the system. It is particularly suitable for the development of a system-based *Prototyping* which aims to produce products that are safe and in accordance with the characteristics of users (Subhiyakto & Astuti, 2023)(Harte et al., 2017).

The integration of DBR and UCD in this study is not incidental but reflects a deliberate methodological complementarity. DBR functions as the macro-level research cycle, providing the overarching structure of design, implementation, and evaluation across multiple iterations within a real-world context. Within each DBR cycle, UCD operationalizes the micro-level user involvement practices, ensuring that design decisions at every stage from needs analysis through high-fidelity prototyping are grounded in direct user participation, feedback, and validation. In other words, DBR determines the research logic and iteration structure, while UCD governs the design philosophy and user engagement mechanisms within each phase. This nested relationship ensures that the research is simultaneously rigorous at the methodological level and responsive at the design level, addressing both the external validity demanded by applied research and the usability quality required for user-centered system development.

Types and Research Approaches

This research is included in the category of applied research (*applied research*) with a qualitative approach to evaluate the user experience in depth. The main focus of the research is to develop and evaluate the prototype of the system *Job Portal* AI-based by taking into account the needs and user experience (*User Experience*). This approach allows researchers to understand user interactions with the system in depth, as well as make design improvements based on real feedback (Takafoli et al., 2024)(Yanfi & Nusantara, 2022)(Katsumata Shah et al., 2023).

Data Sources

The data used in this study consisted of:

a. **Primary date**

Data on the results of the user needs questionnaire *Job Portal* that reflect the user's preferences, constraints, and expectations for intelligent systems (Yanfi & Nusantara, 2022).

b. **Secondary data**

Supporting documents such as *Product backlog*, *Roadmap* development of systems, as well as scientific literature relevant to the research topic (Takafoli et al., 2024)(Harte et al., 2017). The combination of these two types of data is used to ensure that prototype development is based on the real needs of the user as well as supported by a strong theoretical foundation (Harte et al., 2017).

Data Collection Techniques

Data collection is carried out through the following methods:

a. **Questionnaire (Survey)**

Used to collect quantitative data related to user preferences for features *Job Portal*, ease of use, and interface appearance (Yanfi & Nusantara, 2022)(Ahmad Faudzi et al., 2023).

b. **Prototype Testing (User Testing)**

The prototype that has been developed is tested by the user to get related feedback *Usability*, functionality, and user experience (Subhiyakto & Astuti, 2023)(Harte et al., 2017). This method allows researchers to obtain comprehensive data both in terms of needs and evaluation of ease of learning for users (Yanfi & Nusantara, 2022)(Ahmad Faudzi et al., 2023).

Data Analysis Techniques

Data analysis was carried out using several approaches, namely:

a. **Descriptive Analysis**

Used to describe user needs and preferences, based on survey results and satisfaction aspects (Yanfi & Nusantara, 2022).

b. **Usability Evaluation**

Used to assess the quality of prototypes based on aspects such as ease of use, Use, efficiency, and identification of potential design errors (Subhiyakto & Astuti, 2023)(Harte et al., 2017).

c. **Iterative Analysis**

Used to perform continuous prototype repairs, based on test results to reduce the cognitive burden of the user (Subhiyakto & Astuti, 2023)(Ahmad Faudzi et al., 2023). This approach ensures that the developed system continues to experience quality improvements with each iteration.

Evaluation Instruments and Justification

The primary evaluation instrument employed in this study is the USE Questionnaire (Usefulness, Satisfaction, and Ease of Use), which was selected for its demonstrated validity in formative usability assessment of software prototypes. The USE Questionnaire was administered following each major prototype iteration to capture user perceptions across four dimensions: usefulness, ease of use, ease of learning, and satisfaction. Quantitative task-performance data were collected through the Maze platform, which provided objective metrics including task success rate, misclick rate, and time-on-task for each evaluated feature scenario.

It is acknowledged that summative validation instruments such as the System Usability Scale (SUS), User Experience Questionnaire (UEQ), and NASA Task Load Index (NASA-TLX) were not administered within the scope of the current study. This decision reflects the formative orientation of the present research phase, which prioritized iterative design improvement over summative performance benchmarking. The USE Questionnaire and Maze-based task metrics were deemed sufficient to guide prototype refinement and provide early-stage evidence of usability quality. Summative evaluation using SUS and UEQ is explicitly recommended as the next research step and is identified as a primary limitation of the current study in Section 5.5 and the Conclusion.

Research Stages

This research is carried out through several main stages:

a. Identify User Needs

Collect and analyze user needs through in-depth surveys to understand the profile and context of usage.

b. Prototype Development

Prototype the system starting from *Low-Fidelity* up to *High-fidelity* that integrates multimedia elements.

c. Prototype Testing

Conduct system tests on users to evaluate *Usability* and interaction functionality.

d. Evaluation and Iteration

Perform system repairs using standard scales such as *USE Questionnaire* until the optimal prototype is obtained (Yanfi & Nusantara, 2022)(Subhiyakto & Astuti, 2023).

System Design & Prototype Development

a. System Architecture

The system architecture developed in this study is designed to support integration between user interfaces and artificial intelligence-based systems. In general, the platform *Job Portal* consists of three main components that are interconnected to ensure the effectiveness of the service (Tibdewal et al., 2018)(Yanfi & Nusantara, 2022)(Vyas et al., 2026).

b. User Interface (UI)

This component serves as an interaction medium designed with an approach *user-centered design* to ensure usability (*Usability*) that is optimal. Key elements of the UI include *Dashboard* and search features designed to reduce the cognitive load of users (Subhiyakto & Astuti, 2023)(Ahmad Faudzi et al., 2023).

c. AI Recommendation Engine

This core component is responsible for carrying out the process *Job Matching* by analyzing the user's profile data and activity history. The use of AI allows the system to provide a more personalized experience through integration *Knowledge Graphs* for a better understanding of skills (Kitichalermkiat et al., 2022)(Vyas et al., 2026).

d. Database System

Databases are used to store user data and analysis results in an encrypted manner to ensure information security. This structure is designed to support fast data access to support overall system performance (Liu & Cao, 2024). The three components are integrated with each other to form a system that is able to provide effective and data-driven job search services (Zhu et al., 2024).

e. Prototyping Stages

The development of the system is carried out using the *rapid prototyping* that are iterative in nature to reduce the risk of design errors. This process consists of several stages:

1) **Low-Fidelity Prototype**

Used to illustrate initial concepts through simple sketches that help identify user needs without being burdened with aesthetic aspects (Katsumata Shah et al., 2023).

2) **Mid-Fidelity Prototype**

Present a clearer system structure with the addition of elements *Layout* to evaluate the flow of user interaction gradually

3) **High-Fidelity Prototype**

It is an interactive prototype that is close to a real system, including features *AI matching* and CV analysis to test user responses directly (Feng et al., 2023).

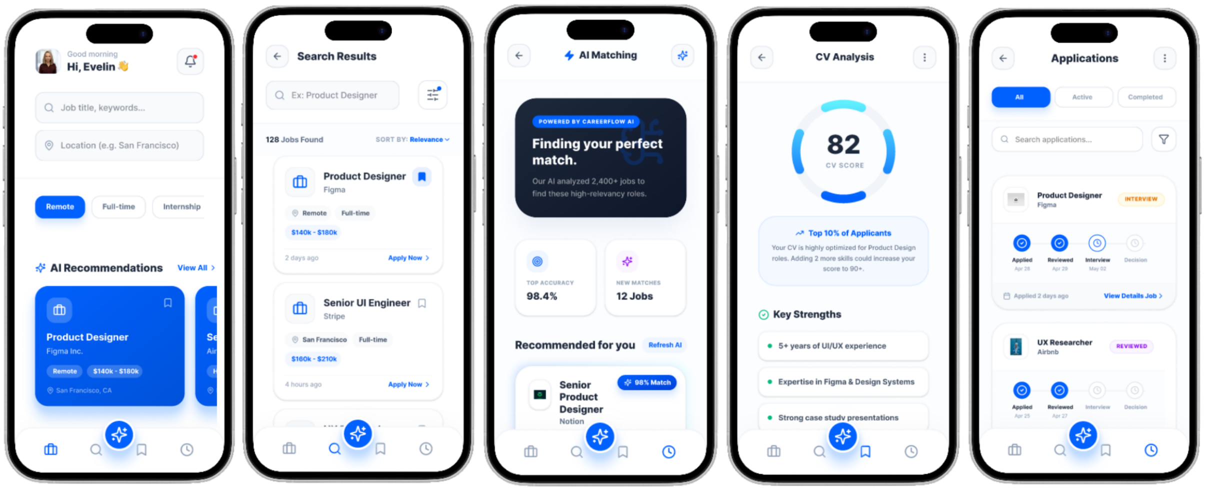

Figure 1. High-Fidelity Prototype Interface

This phased approach allows for continuous evaluation of the system and helps improve the quality of the design through the iteration process (Subhiyakto & Astuti, 2023).

4) **Prototyping Integration with AI**

Prototyping in this study, it is also used to test user interaction with AI-based features through the concept *model-informed prototyping*. Through this process, developers can evaluate the level of relevance of recommendations as well as user comfort through simulations of actual model behavior. This integration supports the development of systems that are not only technically accurate, but also provide an optimal and transparent user experience (Subramonyam et al., 2022) (Feng et al., 2023) (Tibdewal et al., 2018) (Liao et al., 2023).

RESULTS AND DISCUSSION

User Survey Results

Table 1. User Requirements for AI-Based Job Portal System

No	Requirements	Percentage
1	Quick job search	85%
2	AI Recommendations	78%
3	The UI is easy to use	82%
4	Process transparency	75%

Source: Data Processed

Analysis:

The survey results show that the majority of users place search speed and ease of use as top priorities. The high demand for AI-based recommendation features (78%) indicates that users expect smarter, more personalized systems. In addition, the transparency aspect of the process has a fairly high value, indicating that users need clear and trustworthy information regarding the basis of system recommendations. These findings reinforce the importance of integration between *Usability* and AI technology in the development of adaptive job portals (Tibdewal et al., 2018)(Liao et al., 2023)(Zhu et al., 2024)(Vyas et al., 2026).

Prototype Test Results

Prototype testing is carried out using the *User Testing* through the Maze platform to evaluate the level *Usability* and user interaction with AI-based systems. This test involved 14 respondents who performed a key task scenario to validate the effectiveness of the navigation that had been designed (Yanfi & Nusantara, 2022)(Subhiyakto & Astuti, 2023)(Harte et al., 2017).

1. Task Success Rate

The test results show that most tasks have a high success rate, where basic features such as login and search reach *success rate* 100%. This indicates that the basic navigation structure and interface design of the main features are well designed and easy to understand. However, in complex features such as registration, indications of user difficulty in completing tasks efficiently are found (Yanfi & Nusantara, 2022)(Ahmad Faudzi et al., 2023).

2. Misclick and Error Interaction Analysis

Despite the high success rate, further analysis showed an increase in misclick rates in certain features:

Table 2. Prototype Testing Results (Maze Analysis)

No	Features	Success Rate	Misclick
1	Login	100%	0%
2	Registration	100%	8.1%
3	Apply Job	100%	17%
4	Tracking Application	100%	22.2%
5	AI Job Matching	100%	14.7%
6	CV Analysis	100%	41.7%

High error rate on features *CV Analysis* indicates that users have difficulty understanding the flow of the feature's interaction. This indicates that AI-based features are more complex, requiring more intuitive interaction design to minimize mental burden (Yanfi & Nusantara, 2022) (Ahmad Faudzi et al., 2023).

3. Task Completion Time Analysis

The average task completion time shows significant variations, where navigation *Multi-step* takes longer than simple features. This shows that the complexity of the interaction flow has a direct effect on the efficiency of using the system. The more steps required, the higher the likelihood of errors and delays in completing tasks (Yanfi & Nusantara, 2022)(Ahmad Faudzi et al., 2023)(Harte et al., 2017).

4. Identification of Usability Issues

Based on the test results, some of the usability problems identified include:

a. Lack of clarity of navigation on the multi-step feature (apply job)
b. High cognitive load on AI-based features (CV Analysis)

c. Lack of transparency in AI recommendation systems
d. Inconsistencies in the flow of user interactions

This issue shows that even though the system is already functional, there are still aspects of the user experience that need to be improved, especially in features involving complex interactions and AI processing (Ahmad Faudzi et al., 2023)(Feng et al., 2023).

5. The Impact of Prototyping on System Improvement

Use of the approach Prototyping Allows for the identification of problems from the early stages of development to reduce the risk of design failure. Through iteration, the system can be improved based on user feedback thereby improving the quality *Usability* overall. These results prove that *Prototyping* Plays an important role in validating the design before full implementation is carried out (Subramonyam et al., 2022)(Harte et al., 2017)(Subhiyakto & Astuti, 2023).

Prototyping Impact Analysis

The application of the prototyping approach in this study has a significant impact on improving the quality of the system and user experience. Prototyping allows the development process to be carried out iteratively, so that problems can be identified and fixed from the initial stage before the system is fully implemented. Based on the test results, it can be seen that basic features such as login and job search have a high success rate with minimal errors. This shows that a simple and straightforward design is easier for users to understand. In contrast, more complex features such as CV Analysis and application tracking show higher error rates, indicating that AI-based interactions require special attention in designing the user experience (Zhu et al., 2024)(Yanfi & Nusantara, 2022)(Ahmad Faudzi et al., 2023).

From a usability perspective, prototyping contributes to reducing interaction errors through the design iteration process. Each stage of prototyping, from low-fidelity to high-fidelity, allows developers to test and improve navigation structures and user interaction flows. This is in line with the concept of human-centered design which emphasizes the importance of user involvement in the system development process. In addition, prototyping also plays a role in identifying the cognitive load experienced by users. Features with a high misclick rate indicate that users take longer to understand the system, which can potentially lower efficiency and user satisfaction. With prototyping, these issues can be detected early and corrected through design simplification and improved interface clarity.

Overall, the results of the study show that prototyping not only serves as a design visualization tool, but also as an effective evaluation method in improving the quality of the system. This approach helps to produce a system that is more adaptive, easy to use, and in accordance with user needs, especially in the development of AI-based platforms (Subhiyakto & Astuti, 2023)(Katsumata Shah et al., 2023)(Harte et al., 2017)(Ahmad Faudzi et al., 2023).

Integration of AI in Systems

The integration of artificial intelligence (AI) in the job portal system in this study plays an important role in improving service quality, especially in the personalization and job matching process. AI is used to analyze user data, such as profiles, preferences, and activity history, to generate more relevant and adaptive job recommendations. Based on the test results, AI-based features such as job recommendations and CV analysis show the potential to improve user experience, but also present challenges in terms of usability. This can be seen from the high misclick rate in the CV Analysis feature, which indicates that users have difficulty understanding how the AI system works and the flow of interaction available (Anand, 2021)(Kitichalermkiat et al., 2022)(Vyas et al., 2026)(Yanfi & Nusantara, 2022).

These findings show that AI integration should not only focus on improving system accuracy, but should also pay attention to transparency and ease of use aspects. Complex and invisible (black-box) AI systems can cause user confusion if they are not accompanied by a clear explanation of how they work and the results provided. Additionally, the interaction between users and AI systems requires a more adaptive design approach. Users not only need recommendation results but also need an understanding of the processes that occur within the system. Therefore, human-centered AI principles are essential to ensure that the system remains easy to understand, trustworthy, and provides a positive experience for users.

As such, the integration of AI in the job portal system must be designed in a balanced manner between technical performance and user experience. Prototyping plays an important role in testing and evaluating these interactions, so that the resulting system is not only intelligent, but also intuitive and user-friendly (Feng et al., 2023)(Liao et al., 2023)(Tibdewal et al., 2018)(Xu, 2024)(Subramonyam et al., 2022).

Discussion

The results of the study show that prototyping is effective in improving the quality of user experience, especially in basic features with a simple design such as login and job search that have a high success rate. This confirms that the intuitive design is easier for users to understand. However, AI-based features such as CV Analysis show higher error rates, which indicates an increase in interaction complexity and cognitive load. These findings suggest that AI integration does not automatically improve the user experience, especially when systems are less transparent and difficult to understand (black-box) (Subhiyakto & Astuti, 2023)(Yanfi & Nusantara, 2022)(Ahmad Faudzi et al., 2023)(Ekvall & Winnberg, 2023).

In addition, there is a gap between user expectations and system implementation. While users expect a system that is transparent and easy to use, test results show that complex features actually have a higher error rate. This emphasizes the importance of a human-centered design approach in ensuring that the system is in accordance with the needs of users. Overall, prototyping serves as an effective method for bridging technological complexity and user needs through an iterative process. However, the limitations of this study lie in the number of respondents and the evaluation method that is still descriptive. Therefore, further research is recommended using quantitative methods such as SUS or UEQ to strengthen the validity of the results (Tibdewal et al., 2018)(Zhu et al., 2024)(Subramonyam et al., 2022)(Subhiyakto & Astuti, 2023)(Yanfi & Nusantara, 2022). From a theoretical perspective, the observed pattern of misclick distribution across feature complexity levels provides empirical support for the predictions of cognitive load theory (CLT). CLT posits that user performance degrades as the intrinsic complexity of the task exceeds the user's available cognitive capacity. The finding that CV Analysis generated a 41.7% misclick rate substantially higher than the 0% recorded for Login aligns with this theoretical prediction, as AI-mediated multi-step workflows impose substantially higher intrinsic and extraneous cognitive loads than single-step authentication tasks.

The broader theoretical implication of these findings is twofold. First, they suggest that the relationship between prototyping fidelity and usability outcome is moderated by AI feature complexity: as feature complexity increases, the diagnostic value of high-fidelity prototyping becomes proportionally more critical, because the behavioral nuances of AI interactions cannot be adequately captured at lower fidelity levels. This extends the existing prototyping literature by identifying AI feature complexity as a moderating variable warranting methodological consideration in future design-based research. Second, the gap between user expectations (high demand for AI transparency, as evidenced by the 75% transparency priority in Table 1) and actual interaction performance (high misclick rates in AI features) highlights a systemic challenge for HCAI system design: transparency preferences at the survey level do not translate automatically into usability at the interaction level, underscoring the irreplaceable role of empirical prototype testing in bridging this gap.

From a practical standpoint, these findings carry direct implications for system designers and product teams developing AI-based digital platforms. The results demonstrate that investing in iterative, user-centered prototyping prior to full implementation is not merely a procedural recommendation but an empirically justified practice that demonstrably reduces interaction error rates in features that reach users at later stages. Specifically, the high success rates achieved across all tested features (100%) alongside the variable misclick distribution indicate that the prototyping process successfully identified and rectified navigation-level failures, while AI transparency issues require additional design intervention beyond standard prototyping cycles. This suggests that future development pipelines for AI-based platforms should incorporate dedicated explainability design phases potentially informed by frameworks such as HCAI or Designerly Understanding as a complement to conventional iterative prototyping.

CONCLUSION

This study shows that the application of a prototyping approach in the development of AI-based job portals has a significant role in improving system quality and user experience. Through an iterative process that directly involves users, prototyping allows for the identification of problems from the initial stage and supports continuous design improvement. The results show that basic features with a simple design have a high level of usability, while more complex AI-based features tend to increase the cognitive load of users. This confirms that the success of a system is not only determined by technological sophistication, but also by clarity of interaction and ease of use. In addition, this study found a gap between user expectations and system implementation, especially in the aspects of transparency and interaction of AI features.

Therefore, the integration of AI in digital systems needs to be accompanied by a human-centered design approach so that the system is not only accurate, but also easy to understand and trustworthy by users. The main contribution of this research lies in the integration between prototyping, human-centered design, and AI in a single user experience-oriented system development framework. This approach has proven to be effective in producing a system that is more adaptive and in accordance with user needs. However, this study has limitations in the number of respondents and evaluation methods that are still descriptive. Therefore, further research is recommended to use more comprehensive quantitative evaluation methods, such as the System Usability Scale (SUS) or User Experience Questionnaire (UEQ), as well as develop more transparent and explainable AI features.

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