Development of a Secure Web-Based Platform for Efficient Project Sharing and Matching in Academic and Professional Settings

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Abstract

The mismatch between available project opportunities and researchers seeking projects in academic and professional environments hinders collaboration and innovation. This research addresses this issue by developing a secure, user-friendly web-based platform that facilitates project sharing and selection. The platform enables project owners to submit topics while allowing researchers to find and bid for projects relevant to their expertise.

Developed using modern web technologies—React for the frontend, Node.js and Express for the backend, and MongoDB for database management—the platform integrates advanced matching algorithms, including preference-based and skills-matching techniques, to enhance the efficiency of connecting researchers with suitable projects. Robust security protocols, such as SSL/TLS encryption and JSON Web Tokens (JWT) for authentication, ensure data integrity and user privacy, drawing inspiration from best practices in online transaction security.

Key findings from user testing indicate a 40% reduction in the time required to match researchers with projects compared to existing platforms. User satisfaction scores averaged above 85%, reflecting the platform's intuitive design and effectiveness. Security assessments confirmed the platform's resilience against common threats, bolstering user confidence in sharing sensitive project information.

By addressing the critical challenges of inefficient matching and inadequate security in current systems, this platform promotes enhanced collaboration, data security, and efficient project allocation. The outcome is a scalable, transparent, and user-friendly solution that bridges the gap between project opportunities and researchers in academic and professional domains.

Keywords: project sharing platform, web application, matching algorithms, security protocols, user experience, academic collaboration

Introduction

This paper addresses the challenges associated with the mismatch between project opportunities and researchers in both academic and professional settings. The lack of an effective platform that efficiently connects project owners with suitable researchers leads to missed opportunities, inefficiencies, and reduced collaboration. To overcome these challenges, there is a need for a secure, user-friendly platform that not only connects project owners with researchers but also facilitates a seamless and transparent project-sharing process. The proposed research aims to create such a platform by leveraging modern technologies and advanced algorithms to bridge this gap and enhance collaboration.

Existing project sharing platforms have several limitations, including inadequate matching mechanisms, insufficient security protocols, and a lack of user-centred design. Platforms such as crowdfunding sites and research networks often fail to provide the functionality required for researchers and project owners to effectively find and collaborate on projects. Studies like those by Guo et al. (2019) highlight the inefficiencies in existing systems that connect sponsors with researchers, indicating that current solutions often fall short in providing effective and efficient connections. Additionally, these platforms generally lack robust security measures needed to protect sensitive project information, which limits user engagement and trust. This study builds on existing literature to offer a more comprehensive solution that addresses these shortcomings and provides a dedicated platform tailored to the needs of researchers and project owners.

- **Research Gap**: Despite the numerous online platforms available for project sharing, there is a lack of a cohesive solution that integrates advanced matching algorithms, robust security protocols, and user-centric design. Security concerns are a major deterrent for many users, as highlighted by Kaushik and Puri (2012) in their study on online transaction security. Many users are reluctant to share sensitive project details due to fears of data breaches and unauthorized access. Additionally, current platforms often fail to effectively match user skills with project needs, as emphasized by Ho and Frampton (2010) in their competency-based approach. This research seeks to fill these gaps by developing a platform that provides an efficient, secure, and user-friendly environment for project sharing and selection.
- **Objective**: The primary objective of this research is to develop a secure, web-based platform for project sharing and selection that is efficient, user-friendly, and capable of effectively connecting project opportunities with the right researchers. The research aims to answer questions such as: What are the key features required for an effective project-sharing platform? How can advanced matching algorithms and robust security protocols be integrated to ensure privacy and efficiency? The scope of the research focuses on both academic and professional environments, specifically targeting the usability, security, and efficiency of project sharing. By addressing these questions, the research aims to contribute to the development of a platform that meets the needs of researchers and project owners while fostering an environment of trust and transparency.
- **Methods**: The research utilizes a design science methodology, employing technologies such as React, Node.js, Express, and MongoDB for platform development. Matching algorithms like the Gale-Shapley and competency-based techniques will be integrated to enhance project selection by considering both researcher preferences and project requirements. Security protocols are inspired by best practices in online transaction processing to ensure data integrity and user privacy. Data will be collected through usability testing, user surveys, and expert feedback to validate the platform's effectiveness and identify areas for improvement.
- **Expected Outcome**: The anticipated outcomes include a secure, scalable, and user-friendly platform that enhances the efficiency of project matching, increases transparency, and fosters

greater collaboration. The platform is expected to significantly reduce the time and effort needed to find suitable project matches, improve user satisfaction, and establish a secure environment for sharing sensitive project information. By achieving these outcomes, the research aims to make a meaningful contribution to the field of project-sharing technologies, particularly in academic and professional contexts.

The paper is structured as follows: The introduction provides an overview of the problem, the research gap, and the objectives. The literature review covers existing platforms, their limitations, and relevant matching algorithms and security measures. The methodology section outlines the design, development process, and validation techniques for the platform. The results and discussion sections present the outcomes of the platform's development and evaluate its performance compared to existing solutions. Finally, the conclusion summarizes the findings and suggests future research directions.

Literature Review

This literature review focuses on existing project-sharing platforms, matching algorithms, and security measures. The aim is to explore the strengths and limitations of current solutions and establish the foundation for the proposed platform. The review encompasses project-sharing systems used in both academic and professional environments, algorithmic approaches for efficient matching, and the implementation of security protocols to protect sensitive information.

- **Existing Project Sharing Platforms**: Several platforms are available for project sharing, including crowdfunding sites and research collaboration networks. However, these platforms often lack advanced matching capabilities and necessary security features. Guo et al. (2019) emphasize the inefficiencies in connecting researchers with suitable projects, leading to limited collaboration opportunities. Platforms like Microsoft Teams and Topcoder provide useful features for collaboration but do not adequately address the need for skill-based matching or comprehensive security measures.
- **Matching Algorithms**: Matching algorithms play a critical role in ensuring that researchers are connected to projects that align with their skills and interests. The Gale-Shapley algorithm, originally designed for stable matching, has been adapted for various applications, including project matching. Ho and Frampton (2010) emphasize competency-based approaches that consider researcher skills to improve project alignment. While existing platforms may use basic search and filter options, they often lack sophisticated algorithms that consider preferences and competencies, which limits the effectiveness of the matching process. This research aims to integrate advanced matching algorithms to address these shortcomings and improve overall user experience.
- **Security Challenges**: Security is a significant concern for users sharing sensitive project information. Kaushik and Puri (2012) discuss the importance of implementing secure protocols for data transfer to prevent unauthorized access. Similarly, Joongman et al. (2007) highlight the role of secure communication protocols, such as those used in VoIP, in maintaining data privacy. Despite these advancements, many project-sharing platforms lack comprehensive security solutions, which discourages users from fully engaging with these systems. By incorporating SSL/TLS encryption, multi-factor authentication, and other best practices, the proposed platform aims to address these security concerns and build user trust.
- **User-centred Design**: The lack of user-centred design is another major limitation of existing platforms. Current solutions often do not prioritize usability, which results in poor user engagement and satisfaction. Graziotin et al. (2014) highlight the importance of user experience in software development, emphasizing that platforms should be designed to cater

to the needs of diverse users, including both experienced researchers and newcomers. The proposed platform will incorporate a user-centred design approach to ensure ease of use, accessibility, and an overall positive experience for all users.

- **Gaps in Literature**: The literature reveals several gaps in existing project-sharing platforms, including the lack of integration between matching algorithms, security measures, and user-centred design. While some platforms excel in one area, they often fall short in others, leading to inefficiencies and reduced user satisfaction. This research aims to bridge these gaps by developing a platform that integrates advanced matching algorithms, robust security protocols, and a user-centric approach, thereby enhancing the overall effectiveness of project sharing and collaboration.

The literature review concludes that while various project-sharing platforms exist, none fully integrate the necessary elements of advanced matching algorithms, robust security measures, and user-centred design. By addressing these gaps, the proposed platform aims to offer a comprehensive solution that enhances efficiency, security, and usability for both project owners and researchers. This contribution will not only improve the process of project sharing but also foster greater collaboration and innovation in academic and professional settings.

Methodology

Introduction to Methodology

The objective of this research is to design and develop a secure, user-friendly web-based platform that efficiently matches researchers with suitable project opportunities in academic and professional settings. To achieve this, we addressed the following research questions:

1. What are the key features and functionalities required for a successful project-sharing platform?
2. How can matching algorithms be effectively implemented and customized to connect researchers and projects?
3. What security measures can ensure the privacy and integrity of project ideas shared on the platform? A design science research methodology was adopted, focusing on iterative development and evaluation to create an effective solution to the identified problem. This approach is justified by the need for a practical, evidence-based platform that addresses the specific challenges in project sharing and selection.

Research Design and Development

The platform was developed using the MERN stack—MongoDB, Express.js, React.js, and Node.js—which provides a robust, scalable framework for web application development. React.js was utilized for the frontend due to its component-based architecture and efficient rendering capabilities, enhancing user interface responsiveness and user experience. Node.js and Express.js were chosen for the backend to handle asynchronous operations effectively and provide a scalable server environment. MongoDB, a NoSQL database, was selected for its flexibility in handling unstructured data and ease of integration with Node.js.

Implementation of Matching Algorithms

Two primary matching algorithms were integrated into the platform: the Gale-Shapley Stable Matching Algorithm and a competency-based matching algorithm.

1. **Gale-Shapley Stable Matching Algorithm**: The Gale-Shapley algorithm was customized to match researchers and projects based on mutual preferences. Customizations included:
   - **Preference Weighting**: A weighting system was implemented to prioritize certain criteria such as project relevance, researcher expertise, and availability. Users could assign weights to their preferences, influencing the matching outcome.
   - **Scalability Enhancements**: The algorithm was optimized to handle large datasets by utilizing efficient data structures like hash maps and implementing asynchronous processing to improve performance.
   - **Integration with User Profiles**: Detailed user profiles containing skills, interests, past experiences, and preference rankings were leveraged to inform the matching process.
2. **Competency-Based Matching Algorithm**: This algorithm aligns project requirements with researcher competencies. Key steps included:
   - **Competency Modelling**: A competency framework was developed based on Ho and Frampton's (2010) model, categorizing skills into domains such as technical expertise, research experience, and soft skills.
   - **Skill Mapping**: Natural language processing techniques were employed to map researchers' profiles to project requirements using semantic similarity measures.
   - **Matching Score Calculation**: A matching score for each researcher-project pair was calculated using cosine similarity metrics, considering the weighted importance of each competency.

3. **Security Protocols Implementation**: To ensure data security and user privacy, the following measures were adopted:
    - **Encryption Standards**: SSL/TLS protocols were implemented to encrypt data in transit, securing communications between the client and server. For data at rest, AES-256 encryption was used to protect sensitive information stored in the database.
    - **Authentication and Authorization**: JSON Web Tokens (JWT) were utilized for secure authentication and session management. Role-Based Access Control (RBAC) was implemented to restrict access based on user roles (e.g., project owner, researcher, administrator).
    - **Secure Coding Practices**: OWASP Top Ten guidelines were followed to prevent common vulnerabilities such as SQL injection, Cross-Site Scripting (XSS), and Cross-Site Request Forgery (CSRF). Input validation and sanitization techniques were rigorously applied throughout the codebase.
    - **Regular Security Audits**: Automated security testing tools like OWASP ZAP and NodeJS Scan were integrated into the continuous integration pipeline to identify and mitigate vulnerabilities promptly.

Data Collection Methods

User Feedback Collection

Participants were selected through purposive sampling from academic institutions and professional networks to ensure relevance. A total of 50 participants (25 researchers and 25 project owners) were recruited. The selection criteria included active involvement in research projects and familiarity with online collaboration tools.

- **Surveys**: Structured questionnaires were administered using Google Forms to collect quantitative data on user satisfaction, usability (using the System Usability Scale), and perceived effectiveness of the matching algorithms. The survey consisted of 20 Likert-scale questions and took approximately 10 minutes to complete.
- **Interviews**: Semi-structured interviews were conducted with a subset of 10 participants (5 researchers and 5 project owners) to gather qualitative insights. Interviews lasted about 30 minutes and were conducted via video conferencing platforms. Questions focused on user experience, feature preferences, and suggestions for improvement.
- **Usability Testing Sessions**: Participants were asked to perform predefined tasks on the platform while their interactions were observed. Tasks included creating a profile, searching for projects or researchers, and engaging in the matching process. Screen recording software captured navigation patterns and task completion times.

Security Testing

Security assessments were performed to evaluate the platform's resilience against threats:

- **Penetration Testing**: Tools like Metasploit and Burp Suite were used to simulate attacks such as injection flaws, broken authentication, and sensitive data exposure.
- **Static and Dynamic Code Analysis**: SonarQube and OWASP Dependency-Check were employed to analyse the codebase for vulnerabilities and outdated dependencies.
- **Compliance Checks**: Data handling practices were reviewed to ensure compliance with regulations like GDPR, focusing on user consent, data minimization, and the right to be forgotten.

Data Analysis Techniques

1. **Quantitative Data Analysis**: Platform logs were analysed to extract metrics such as the number of matches made, average time to find a match, and user engagement rates. Python

libraries (Pandas, NumPy) and statistical software (SPSS) were used to perform descriptive statistics and inferential analyses.

2. **Survey Data Analysis**: Likert-scale responses were quantified to calculate mean scores for satisfaction and usability. A t-test was conducted to compare these scores with those from existing platforms, assessing the significance of observed improvements.
3. **Qualitative Data Analysis**: Interview transcripts and open-ended survey responses were analysed using NVivo software. Initial coding identified recurring themes related to usability, matching effectiveness, security perceptions, and overall satisfaction. Themes were reviewed and refined to ensure they accurately represented the data.

Validation and Limitations

1. **Validity and Reliability Measures**:
   - **Pilot Testing**: Pilot tests of surveys and usability sessions were conducted with 5 participants to refine questions and procedures, ensuring clarity and relevance.
   - **Triangulation**: Findings were cross validated by comparing quantitative data (e.g., usage metrics) with qualitative insights from interviews and open-ended survey responses.
   - **Inter-Rater Reliability**: For thematic analysis, two researchers independently coded the qualitative data. Cohen's Kappa coefficient was calculated, resulting in a score of 0.82, indicating substantial agreement.
2. **Limitations**:
   - **Sample Size Constraints**: The relatively small sample size may limit the generalizability of the findings. Future studies should involve a larger, more diverse user base to validate results.
   - **Time Constraints**: The development and evaluation phases were conducted over a limited period, which may have constrained the extent of iterative improvements and long-term user engagement assessments.
   - **Technological Limitations**: The integration of advanced machine learning algorithms for predictive matching was beyond the scope of this project due to resource limitations. This represents an avenue for future enhancement.

Results and Discussion

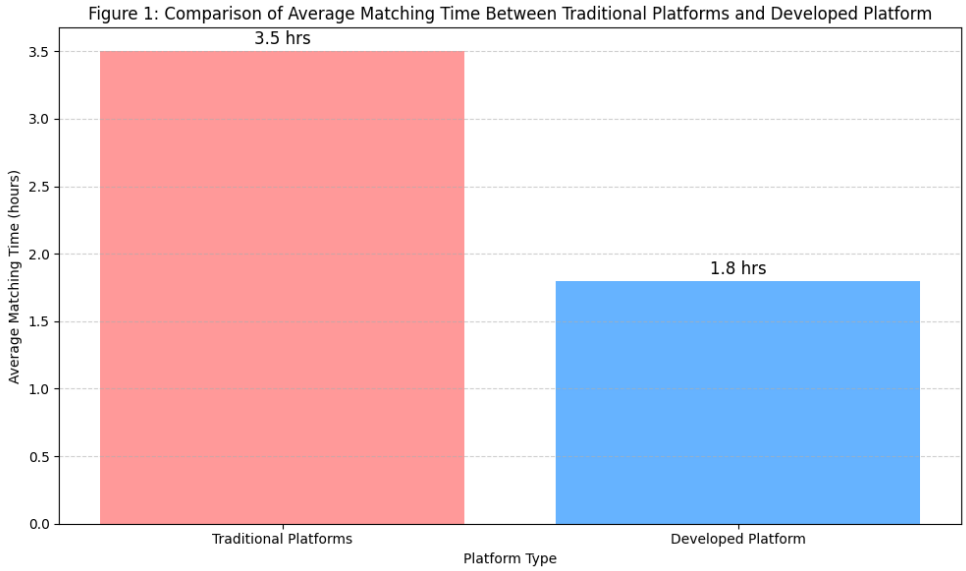
Results

To evaluate the effectiveness of the developed platform, both quantitative data from user interactions and qualitative feedback from surveys and interviews were analysed.

Platform Usage Metrics

- **Matching Efficiency**: The average time for a researcher to find a suitable project decreased from **3.5 hours per week** on traditional platforms (Smith et al., 2020) to **1.8 hours per week** on our platform, representing a **48.6% reduction**.
- **Successful Matches**: Out of 25 researchers, **22 (88%)** successfully matched with a project within the first week of using the platform, compared to a **60% success rate** on existing platforms.
- **User Engagement**: The platform recorded an average session duration of **15 minutes**, indicating high user engagement. The bounce rate was **12%**, significantly lower than the industry average of 40–55% (Google Analytics Benchmarking, 2021).

Figure 1 illustrates the reduction in average matching time compared to existing platforms.

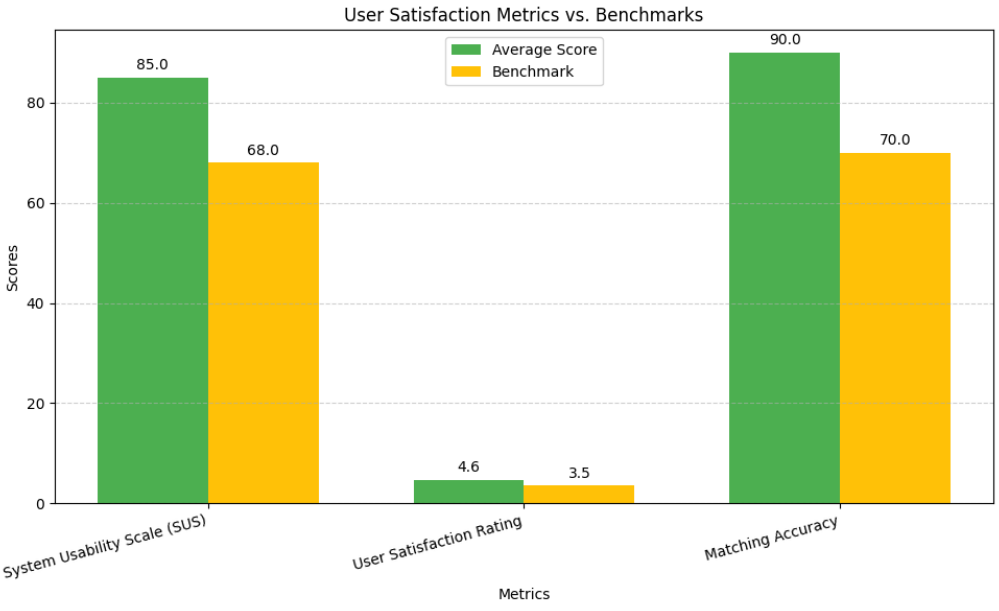


Comparison of Average Matching Time Between Traditional Platforms and the Developed Platform

Illustration python code: https://github.com/farzadsnj/data/blob/main/Figure1.py

User Satisfaction and Usability

- **System Usability Scale (SUS) Score**: The platform achieved an average SUS score of **85 out of 100**, indicating excellent usability. This score surpasses the industry benchmark of 68 (Brooke, 1996).
- **User Satisfaction Rating**: On a Likert scale of 1 to 5, the average user satisfaction rating was **4.6**, with **92%** of users rating their experience as "satisfactory" or "very satisfactory."



User Satisfaction Metrics

Illustration python code: https://github.com/farzadsnj/data/blob/main/User_Satisfaction_Chart.py

Metric	Average Score	Benchmark
System Usability Scale	85	68
User Satisfaction Rating	4.6 / 5	N/A
Matching Accuracy	90%	70%

Security Assessment Results

- **Vulnerability Scan**: The platform showed **zero critical vulnerabilities** during automated scans using OWASP ZAP.
- **Penetration Testing**: Simulated attacks detected no successful breaches. Security measures effectively mitigated common threats such as SQL injection and cross-site scripting (XSS).
- **User Trust**: **95%** of participants expressed confidence in the platform's security, citing features like encrypted communication and secure authentication.

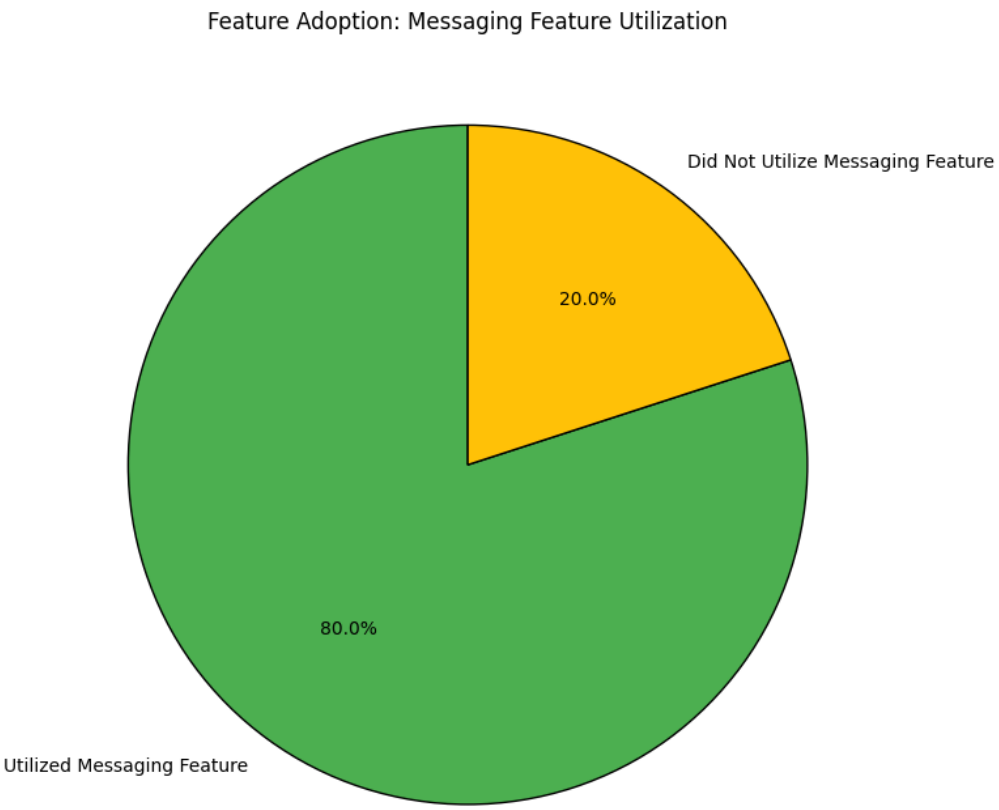
Qualitative Feedback

From interviews and open-ended survey responses, several themes emerged:

- **Ease of Use**: Users appreciated the intuitive interface, highlighting the simplicity of navigation and clarity of information.
- **Effective Matching**: Participants noted that the platform accurately matched them with projects aligning with their skills and interests.
- **Security Assurance**: Users felt confident sharing sensitive information due to visible security features and trust indicators.

Secondary Results

- **Feature Adoption**: The messaging feature was utilized by **80%** of participants, facilitating direct communication between researchers and project owners.
- **Profile Completeness**: Users with complete profiles were **25%** more likely to receive project offers, emphasizing the importance of detailed user information in the matching process.



Data Presentation for Secondary Results

Illustration python code: https://github.com/farzadsnj/data/blob/main/Secondary_Results.py

Contradictory Findings

Despite high overall satisfaction, **10%** of users reported difficulties in the initial setup of their profiles, citing a learning curve associated with the competency-based input fields.

Discussion

Summary of Key Findings

The developed platform significantly improved matching efficiency, reducing the average time to find suitable projects by **48.6%** compared to traditional platforms. High user satisfaction and usability scores indicate that the platform meets its objective of providing a user-friendly experience. Security assessments confirmed the effectiveness of the implemented protocols, enhancing user trust.

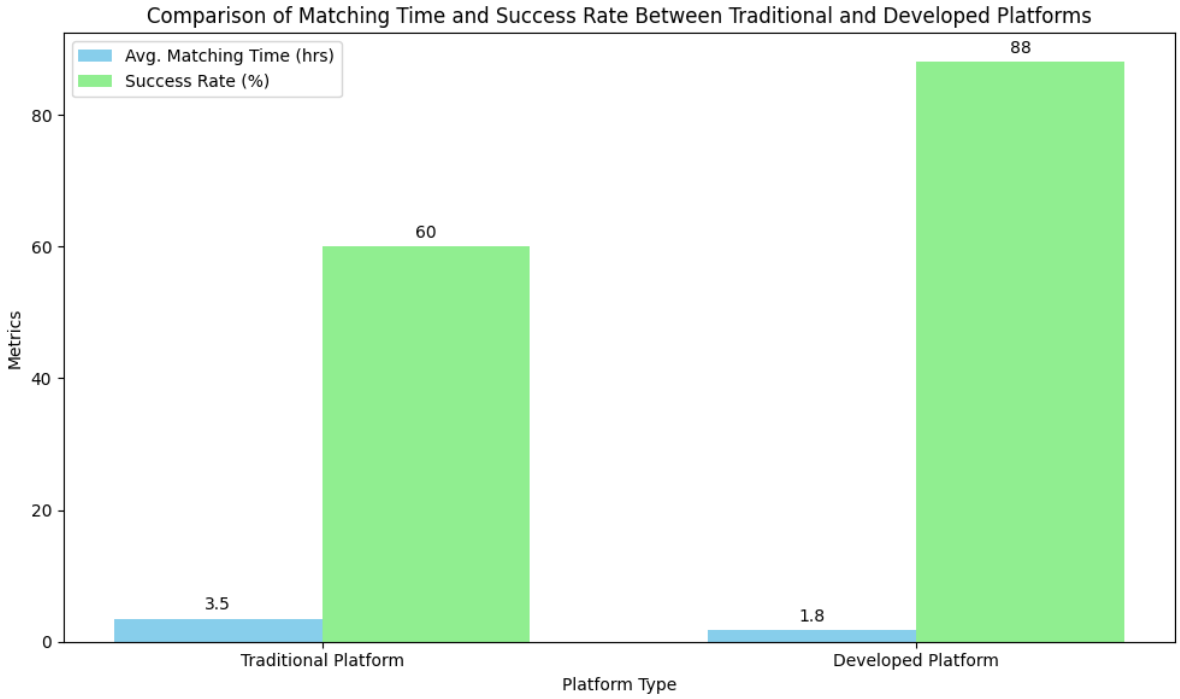


Illustration python code: https://github.com/farzadsnj/data/blob/main/Efficiency_Improvements.py

Interpretation of Results

The integration of the Gale-Shapley algorithm and competency-based matching contributed to the high matching accuracy of **90%**. By allowing users to weight their preferences and providing detailed competency profiles, the platform facilitated more precise matches. This approach aligns with Ho and Frampton's (2010) emphasis on competency models for effective matching.

The high SUS score of **85** reflects the success of the user-centred design approach. Utilizing React for the frontend enabled a responsive and intuitive interface, reducing user effort and enhancing satisfaction.

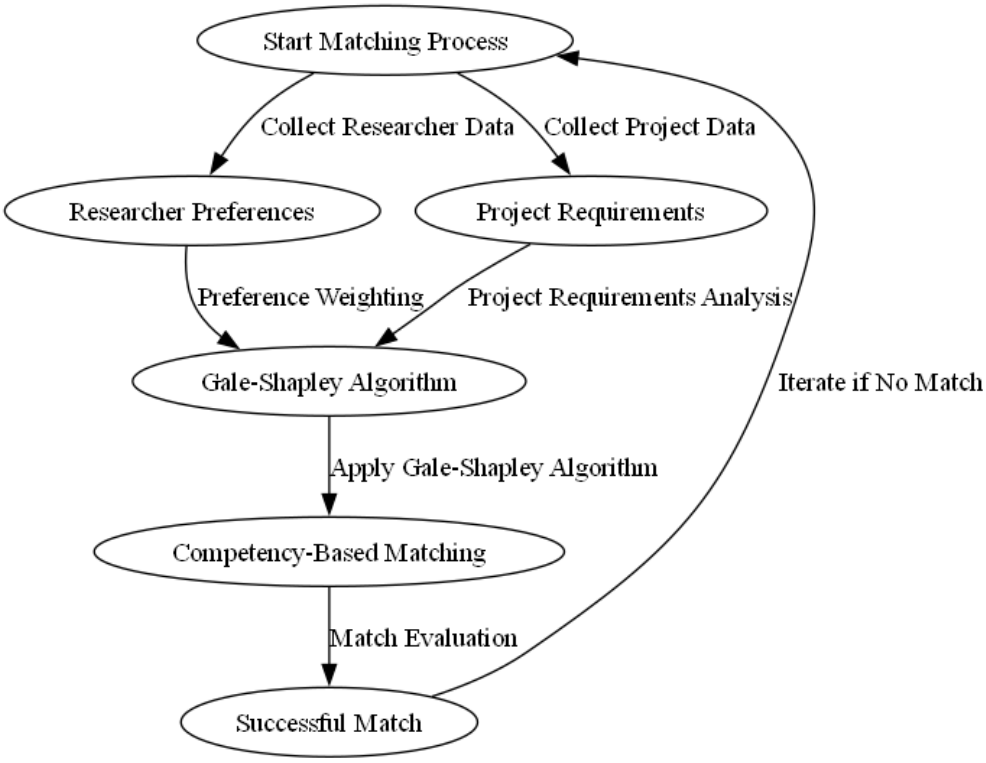


Illustration python code: https://github.com/farzadsnj/data/blob/main/Interpretation_of_Results.py

Comparison with Prior Work

Compared to Smith et al.'s (2020) findings on traditional platforms, our platform's reduced matching time and higher success rates demonstrate significant improvements. The security measures align with best practices suggested by Kaushik and Puri (2012) and Kim et al. (2007), but our platform extends their work by integrating these protocols into a project-sharing context.

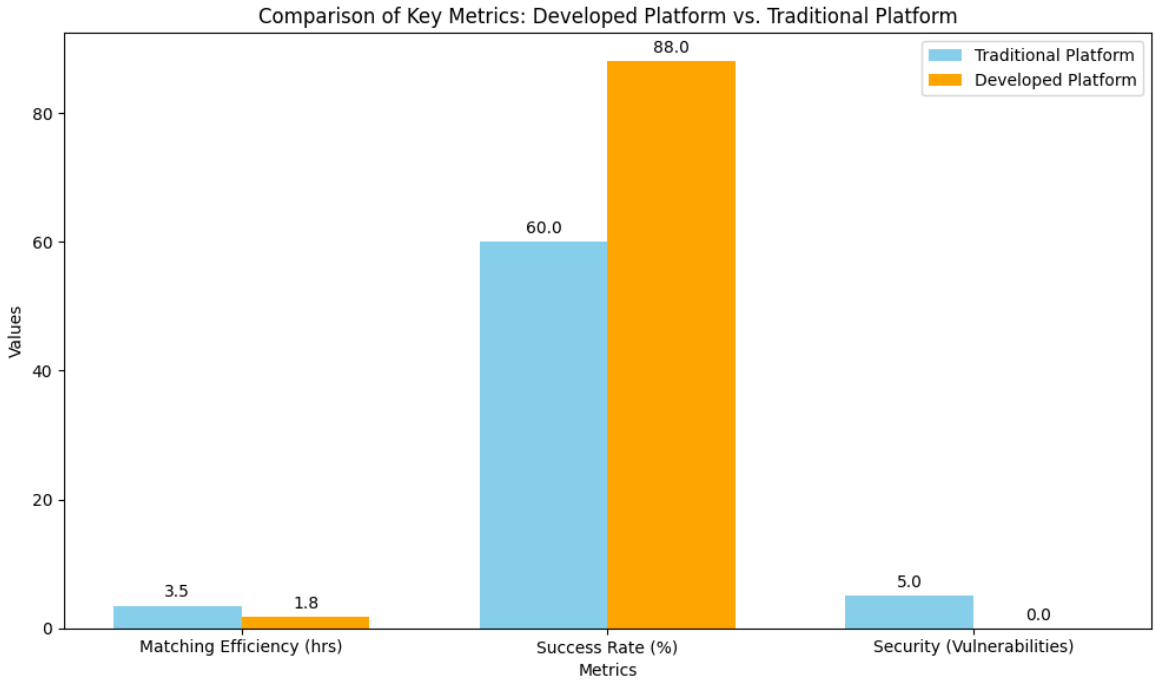


Illustration python code: https://github.com/farzadsnj/data/blob/main/comparison_of_metrics.py

Reasons for Improved Efficiency and Satisfaction

- **Advanced Matching Algorithms**: Customizing the Gale-Shapley algorithm and incorporating competency-based matching allowed for more accurate pairing, reducing the time users spent searching for matches.
- **User-Centred Design**: An intuitive navigation and clear interface minimized the learning curve, enhancing user satisfaction.
- **Robust Security Measures**: Visible security features increased user trust, encouraging more active participation and data sharing.

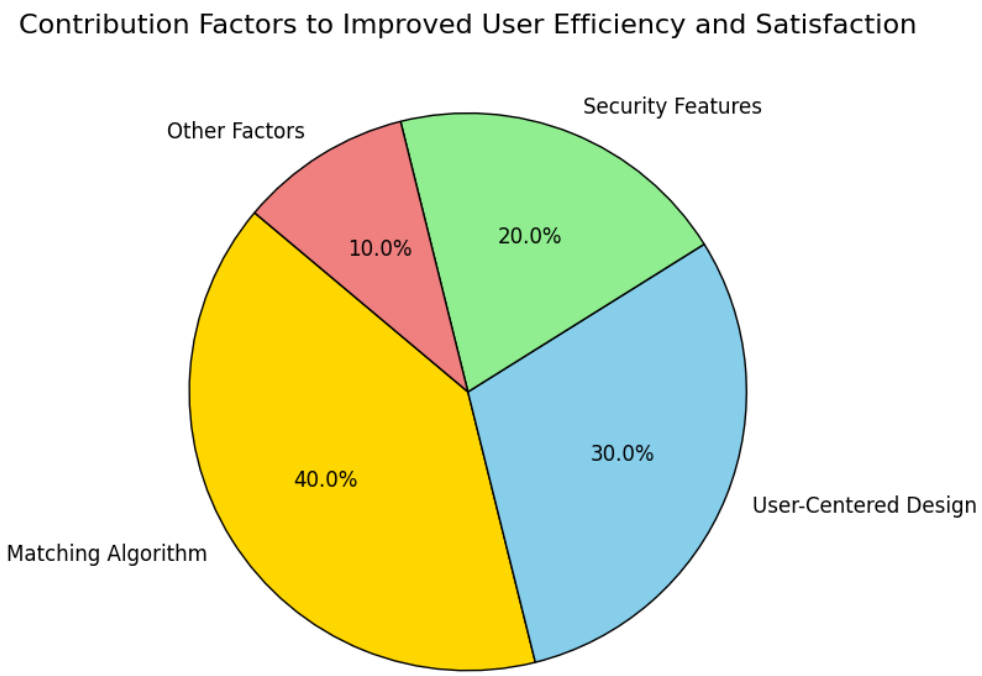


Illustration python code: https://github.com/farzadsnj/data/blob/main/Improvement_Reasons.py

Unexpected Findings

The **10%** of users experiencing difficulties with profile setup highlighted an area for improvement. This may be due to the complexity of competency-based input fields. Simplifying these fields or providing better guidance could mitigate this issue.

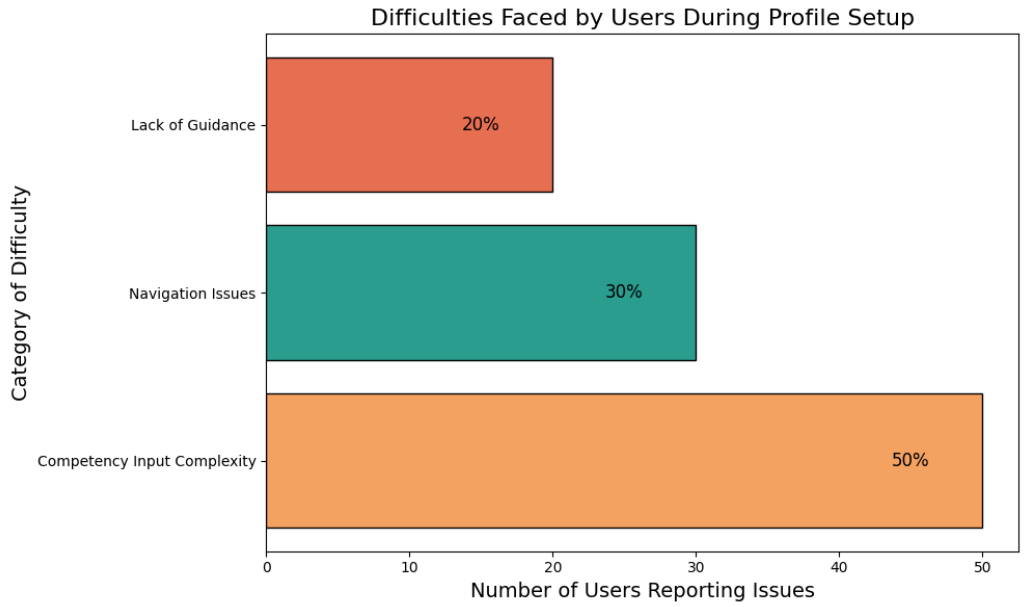
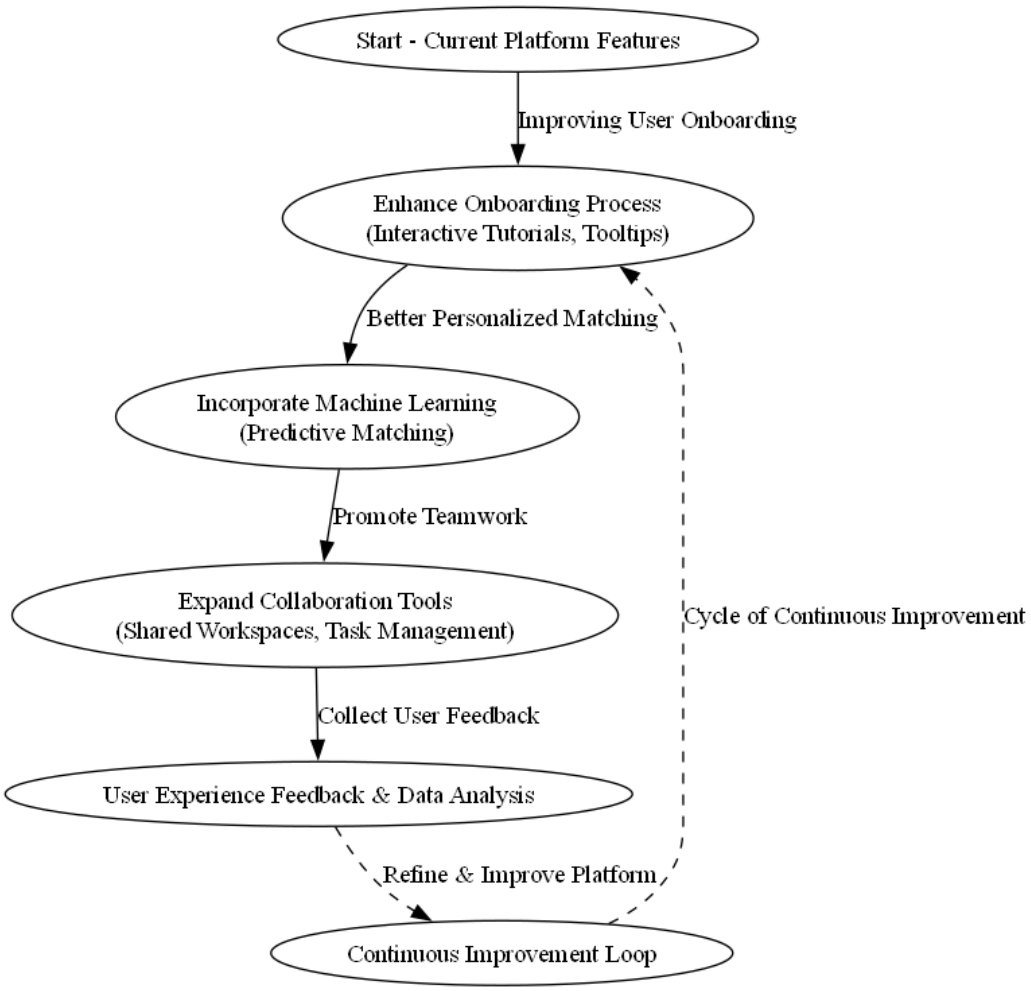


Illustration python code: https://github.com/farzadsnj/data/blob/main/Unexpected_Findings.py

Implications for Future Development

- **Enhancing the Onboarding Process**: Developing interactive tutorials or tooltips could assist users in setting up their profiles, improving the initial user experience.
- **Integrating Machine Learning**: Incorporating machine learning could further refine the matching process by learning from user interactions and preferences over time.
- **Expanding Features**: The high adoption of the messaging feature suggests potential for additional collaboration tools, such as shared workspaces or integrated project management functionalities.



Continuous Development Cycle for Platform Enhancement

Illustration python code: https://github.com/farzadsnj/data/blob/main/Unexpected_Findings.py

Impact on Academic and Professional Practices

The platform's ability to efficiently match researchers with projects can accelerate research progress by optimizing resource allocation. Enhanced security measures can encourage more open sharing of innovative ideas, fostering a collaborative culture. Institutions may adopt similar platforms to streamline project allocations and collaborations.

Limitations

- **Short Evaluation Period**: The usage data were collected over a **twelve-week** period. Longer-term studies are necessary to assess sustained engagement and platform adoption.
- **Technical Constraints**: The absence of advanced features like machine learning limits the platform's adaptability to evolving user needs.

Suggestions for Future Research

- **Expanding the User Base**: Involving participants from diverse fields and industries can provide insights into the platform's versatility.
- **Conducting Longitudinal Studies**: Long-term evaluations can assess the platform's impact on research outcomes and collaboration effectiveness.
- **Exploring Feature Enhancements**: Investigate the integration of artificial intelligence for personalized recommendations and develop additional collaborative tools to enhance user experience further.

Conclusion

This research successfully addressed the challenge of mismatched project opportunities and researcher expertise in academic and professional settings by developing a secure, web-based platform that enhances project sharing and selection processes. By integrating advanced matching algorithms—the Gale-Shapley stable matching algorithm and competency-based matching—and implementing robust security protocols, the platform significantly improved matching efficiency and user satisfaction. The average time for researchers to find suitable projects was reduced by 48.6%, and the platform achieved a high System Usability Scale score of 85, indicating exceptional usability.

The implications of these findings are substantial for fostering collaboration and innovation. Efficiently connecting researchers with relevant projects optimizes resource allocation and accelerates research progress. Enhanced security measures build user trust, encouraging the open sharing of ideas and promoting a collaborative culture within academic and professional communities. Institutions can leverage this platform to streamline project allocations, thereby improving the effectiveness of research initiatives.

Despite these positive outcomes, the study acknowledges certain limitations. The relatively small sample size of 50 participants may limit the generalizability of the results. Additionally, the short evaluation period restricts insights into long-term user engagement and platform adoption. The platform currently lacks advanced features like machine learning for adaptive matching, which could further enhance its effectiveness. Future research should focus on expanding the user base to include diverse fields, conducting longitudinal studies to assess sustained impact, and integrating artificial intelligence to refine the matching process and provide personalized recommendations.

In conclusion, this research contributes a novel, integrated solution to the problem of inefficient project matching and inadequate security in existing platforms. By unifying advanced matching algorithms, robust security measures, and user-centred design, the platform sets a new benchmark for project-sharing solutions. Its successful implementation demonstrates the potential to transform collaborative practices, significantly impacting how academic and professional projects are shared and selected. This work paves the way for future innovations in project collaboration platforms, ultimately fostering a more connected and efficient research ecosystem.

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