# User Centered Design for a Collaborative Academic Project Repository

## Jayson Batoon

*College of Information and Communication Technology, Bulacan State University, Phillipines*

This study, titled "User Centered Design for a Collaborative Academic Project Repository," aims to create an engaging platform that stands out from other project portfolio services. The Student Project Repository promotes a collaborative learning environment across academic institutions, fostering innovation and problem-solving by providing a dynamic space for students to showcase their work. Using a mixed-methods approach, the study gathers student needs and preferences through a university-wide survey and incorporates Agile methodology for responsive development. The evaluation highlights several advantages, including improved mentorship, exposure to multidisciplinary projects, and enhanced collaboration, while noting potential technological challenges. User feedback indicates positive outcomes, with high scores for functional stability (Mean = 4.63, Strongly Agree), performance efficiency (Mean = 4.50, Agree), usability (Mean = 4.93, Agree), reliability (Mean = 4.31, Agree), and maintainability (Mean = 4.46, Agree). The total mean score of 4.45 suggests overall effectiveness, providing insights for future improvements and potential implementation across academic institutions.

**Keywords:** User-Centered Design, Project Repository.

## 1. Introduction

In today's fast-paced academic environment, collaboration and effective information sharing are critical to the success of academic projects. The traditional methods of managing and disseminating project information often fall short, resulting in inefficiencies and a lack of engagement among students and faculty. To address these challenges, the concept of a user-centered design for a collaborative academic project repository has emerged as a promising solution.

A user-centered design approach for academic project repositories is designed to facilitate seamless collaboration, easy access to project information, and enhanced user engagement. By leveraging modern design principles and technology, such repositories aim to create a more efficient and user-friendly environment for academic projects.

The primary objective of this research is to explore the principles and methodologies of user-

centered design in the context of developing a collaborative academic project repository. This involves understanding the needs and preferences of the end-users, including students, faculty, and researchers, and incorporating these insights into the design process. By prioritizing user experience, the repository aims to improve the overall effectiveness and satisfaction of its users.

This paper will delve into the various aspects of user-centered design, including user research, usability testing, and iterative design. It will also highlight the benefits of a collaborative approach to academic project management and how it can lead to better outcomes for all stakeholders involved. Through a comprehensive analysis, this research will provide valuable insights into the development of a collaborative academic project repository that meets the needs of its users and enhances the academic experience.

Studies have shown that students' online information use and learning progress in higher education can significantly impact their academic success [1]. Collaborative online learning environments have been found to foster deeper understanding and engagement among students [2]. The design and implementation of student project allocation systems can streamline project management and enhance student satisfaction [3]. Web-based student project management systems provide a structured approach to managing academic projects, which is crucial for effective collaboration [4].

Moreover, student project management systems have been demonstrated to improve the organization and execution of projects [5]. Teaching innovation through collaborative and team-based learning has proven beneficial in promoting active learning and innovation [6]. Institutional cooperation in educational design and delivery, such as the Engineering 'Hubs and Spokes' project, highlights the importance of collaborative efforts in educational settings [7].

Project-based learning approaches, particularly in technical fields like programmable logic controllers, have shown to enhance practical skills and knowledge application [8]. Connecting students and mentors through local research hubs has been effective in fostering research and mentorship opportunities [9]. Furthermore, involving students as partners in collaborative course design and educational research promotes a sense of ownership and engagement in their learning process [10].

## 2. METHODOLOGY OF THE STUDY

Research Design

The research design for this study is based on a Developmental Descriptive methodology, which aims to provide a comprehensive understanding of user experiences and interactions with the collaborative academic project repository. This approach is selected for its ability to capture detailed qualitative data, essential for creating a user-centered design. User research is conducted through surveys, interviews, and focus groups to gather initial requirements and feedback from potential users. Surveys and questionnaires provide quantitative data to identify general trends and common needs among the user base, while in-depth interviews offer rich qualitative insights into user expectations and pain points. Focus groups facilitate discussions that help uncover common themes and shared challenges, providing a deeper understanding of user needs.

Usability testing is a crucial component of the research design, involving task analysis and think-aloud protocols. Task analysis involves observing users as they perform specific tasks within the repository to identify usability issues, ensuring that the design supports efficient and effective user interactions. The think-aloud protocol involves asking users to verbalize their thoughts while interacting with the repository, providing insights into their decision-making processes and uncovering cognitive challenges. The data collected from these methods are analyzed using thematic analysis and descriptive statistics. Thematic analysis identifies patterns and themes in the qualitative data, offering a rich understanding of user experiences. Descriptive statistics summarize survey data, providing an overview of user demographics, satisfaction levels, and common issues, supporting evidence-based decision-making.

Project Development

The project development methodology is based on the Agile Scrum framework, known for its iterative and flexible approach. Scrum is particularly suitable for this project as it allows for continuous feedback and adjustments, ensuring that the final product meets user needs and expectations.
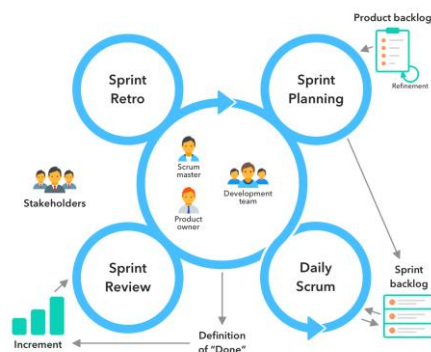


Infinity. (n.d.). Scrum: A comprehensive guide to the methodology. StartInfinity. https://startinfinity.com/project-management-methodologies/scrum

Figure 1 Agile Development Methodology

By integrating Developmental Descriptive design with Agile Scrum, this study aims to create a collaborative academic project repository that is responsive to user needs and provides a seamless user experience. The combination of comprehensive user research and iterative development ensures that the repository is both functional and user-friendly, meeting the expectations of its intended users. This integrated methodology promotes continuous improvement and alignment with user needs, resulting in a repository that effectively supports academic collaboration.

The development methodology for the Student Project Management System is based on the Agile Scrum framework, which is characterized by its iterative and flexible approach. The project unfolded across weekly sprints from August 27, 2023, to November 17, 2023, with a well-organized development plan detailed in the sprint breakdown in Table 1. This methodology allowed for continuous feedback and adjustments, ensuring that the final product meets user needs and expectations.

Sprint Breakdown

Sprints 1 & 2: Foundation Setup

The first two sprints focused on establishing the foundational features of the system, which include user account creation and login options. Essential features like to-do lists, project collaboration tools, and progress monitoring were also developed during these initial sprints. These features set the stage for a functional and user-friendly project repository, enabling users to create accounts, log in, and start managing their projects efficiently.

Sprints 3 & 4: Information Exchange and Communication

Sprints 3 and 4 were dedicated to enhancing the system's capabilities for information exchange and communication. Collaborative editing tools and document sharing with version control were implemented, allowing users to work together seamlessly on shared documents. Project display settings were optimized for simple navigation, ensuring that users could easily find and manage their projects. Additionally, a search feature was introduced to help users locate specific projects, documents, or team members, and a notification system was developed to keep users updated on project activities and changes.

Sprints 5 & 6: Project Support and User Control

The focus of sprints 5 and 6 was on project support and user control. These sprints involved integrating project review features with external resources such as research articles or tutorials, enriching the user experience and providing valuable learning opportunities. Enhancements in user control settings were also made, allowing users to customize their project environments and manage their project settings more effectively.

Sprints 7 & 8: Security and Platform Health

The final sprints prioritized the security and health of the platform. A robust security system was implemented, featuring encryption and access control to safeguard user data. Ongoing monitoring mechanisms were put in place to ensure the smooth operation of the platform, and a dispute resolution system was established to provide a safety net for any conflicts that might arise. These measures ensured that the platform remained secure, reliable, and user-friendly.

Data Gathering Procedure

The data collection began after the researchers demonstrated the developed student project hub to the Information Technology (IT) students, by distributing the link of the survey questionnaire to the respondents. The survey collected information on students' preferences and needs related to collaborative project work, communication, file sharing and other relevant aspects as shown in Figure 1.

Population and Sample

This study involves students who are enrolled in the Bulacan State University. The evaluation focuses on a recently developed student project hub, seeking feedback from a representative group of participants. Their perspectives play a crucial role in assessing the functionality and effectiveness of the project hub in the context of their academic endeavors. The collected feedback contributes significantly to ongoing efforts to enhance and optimize the platform, ensuring its alignment with the needs and preferences of students within the university.

Statistical Treatment

The Five-point Likert Scale is a widely used method for measuring attitudes, opinions, or perceptions across a range of topics. It allows respondents to express how much they agree or disagree with a particular statement, providing a nuanced view of their perspectives. The scale consists of five points, each representing a different level of agreement or disagreement. At the highest end, a rating of 5, or "Strongly Agree," corresponds to a range of 4.50 to 5.00, indicating a very high level of agreement with the statement. Respondents selecting this option feel very strongly in favor of the statement, showing enthusiastic endorsement.

A rating of 4, or "Agree," which ranges from 3.50 to 4.49, suggests general agreement. While not as intense as "Strongly Agree," it still shows a clear positive inclination towards the statement. The midpoint of the scale, a rating of 3 or "Moderately Agree," spans from 2.50 to 3.49. This indicates a moderate level of agreement, suggesting a neutral or balanced perspective, where respondents are somewhat in favor but with less intensity.

On the lower end, a rating of 2, or "Disagree," ranging from 1.50 to 2.49, represents a general opposition to the statement. Respondents who select this option are inclined to disagree but do not feel as strongly as those who "Strongly Disagree." Finally, a rating of 1, or "Strongly Disagree," covering a range of 1.00 to 1.49, indicates a very high level of disagreement. Respondents who select this option feel very strongly against the statement, showing a significant negative opinion.

The Five-point Likert Scale is commonly used in surveys and questionnaires because it provides a simple, yet effective way to gauge a range of opinions and attitudes. This scale allows for quantitative analysis of subjective data, making it easier to interpret and understand the intensity of respondents' feelings about a given topic. For example, in a survey about a new project management system, respondents might rate their agreement with the statement, "I find the new project management system easy to use," using this scale. By analyzing the distribution of responses, researchers can draw conclusions about overall user satisfaction and identify areas for improvement.

Table 1 Five-point Likert Scale

| Scale | Range | Descriptive Rating |
|-------|-------|--------------------|
| 5 | 4.50 – 5.00 | Strongly Agree |
| 4 | 3.50 – 4.49 | Agree |
| 3 | 2.50 – 3.49 | Moderately Agree |
| 2 | 1.50 – 2.49 | Disagree |
| 1 | 1.00 – 1.49 | Strongly Disagree |

Feature Prioritization through Product Backlogs

Implementing features for a web-based project management system was approached using Agile methodology, focusing on iterative development and user feedback. Features were prioritized based on their importance to the end-users and the system's overall functionality. High-priority features such as User Account Creation, User Login and Authentication, and To-Do Lists were scheduled for early sprints to ensure core functionalities were established early in the development process. These features are crucial for basic system operation and user engagement, thus forming the foundation upon which additional functionalities could be built as shown in table 1.

User Account Creation and Authentication

User Account Creation and User Login and Authentication were identified as critical features (ID 1 and 2, respectively) with high priority. These features enable users to securely create and access their accounts, ensuring that personal and project data are protected. Implementing these features in Sprint 1 allowed for the establishment of a secure user environment, which is essential for building trust and reliability in the system.

Task Management and Collaboration

To-Do Lists (ID 3) and Project Collaboration Tools (ID 4) were also given high priority and scheduled for early sprints (Sprint 2). These features provide essential tools for users to manage their tasks and collaborate effectively on projects. To-Do Lists allow users to create, edit, and delete tasks, facilitating personal and team task management. Project Collaboration Tools support team interactions through task assignments and shared workspaces, enhancing collaboration and productivity.

Progress Monitoring and Collaborative Editing

Progress Monitoring (ID 5) and Collaborative Editing Tools (ID 6) are crucial for tracking project milestones and enabling multiple users to work on documents simultaneously. These features, implemented in Sprint 2 and Sprint 3 respectively, provide users with real-time updates on project progress and allow for collaborative work, which is vital for the dynamic nature of academic projects.

Document Sharing with Version Control

Document Sharing with Version Control (ID 7), scheduled for Sprint 3, was prioritized to medium. This feature allows users to share documents and maintain version control, ensuring

that all team members have access to the latest document versions. This is essential for maintaining consistency and accuracy in collaborative projects.

By following this structured approach, the development team ensured that the most critical features were delivered first, providing a robust foundation for further enhancements. This methodology not only catered to the immediate needs of the users but also allowed for flexibility in accommodating future user feedback and requirements.

Table 2 Product Backlogs

| ID | Feature | Description | Priority | Sprint | ID | Feature | Description | Priority | Sprint |
|----|---------|-------------|----------|--------|----|---------|-------------|----------|--------|
| 1 | User Account Creation | Allow users to create accounts with unique usernames and passwords. | High | 1 | 1 | User Account Creation | Allow users to create accounts with unique usernames and passwords. | High | 1 |
| 2 | User Login and Authentication | Enable users to log in to the system securely. | High | 1 | 2 | User Login and Authentication | Enable users to log in to the system securely. | High | 1 |
| 3 | To-Do Lists | Provide users with a feature to create, edit, and delete to-do lists for their projects. | High | 2 | 3 | To-Do Lists | Provide users with a feature to create, edit, and delete to-do lists for their projects. | High | 2 |
| 4 | Project Collaboration Tools | Develop tools for team collaboration, including task assignments and shared workspaces. | High | 2 | 4 | Project Collaboration Tools | Develop tools for team collaboration, including task assignments and shared workspaces. | High | 2 |
| 5 | Progress Monitoring | Implement a feature to track project progress and milestones. | High | 2 | 5 | Progress Monitoring | Implement a feature to track project progress and milestones. | High | 2 |
| 6 | Collaborative Editing Tools | Enable multiple users to edit documents simultaneously. | Medium | 3 | 6 | Collaborative Editing Tools | Enable multiple users to edit documents simultaneously. | Medium | 3 |
| 7 | Document Sharing with Version Control | Allow users to share documents and maintain version control. | Medium | 3 | 7 | Document Sharing with Version Control | Allow users to share documents and maintain version control. | Medium | 3 |

Sample Population

Distribution and Relevance

Table 3 shows the sample population consists of 60 participants, divided into three main groups: undergraduate students, graduate students, and faculty members. Each group was chosen based on their direct involvement in academic projects and their ability to provide valuable feedback on the collaborative academic project repository.

Undergraduate Students: Comprising 50% of the sample, undergraduate students were selected because they represent a significant portion of the repository's target users. These students are typically involved in project-based courses and require efficient tools for task management and collaboration. Their feedback is crucial for understanding the usability of the repository from the perspective of users with varying levels of experience.

Graduate Students: Representing 25% of the sample, graduate students were included to provide insights from users who are more deeply engaged in research projects. Their advanced experience with project management tools allows them to offer detailed feedback on the repository's functionality and potential improvements.

Faculty Members: Also making up 25% of the sample, faculty members play a key role in overseeing student projects and conducting their own research. Their expert experience in project management and collaboration is essential for evaluating the effectiveness of the repository's features and ensuring it meets academic standards.

Table 3 Sample Population

| Participant Group | Number of Participants | Percentage of Total Sample | Key Characteristics |
|---|---|---|---|
| Undergraduate Students | 30 | 50% | - Currently enrolled in project-based courses<br>- Basic to intermediate experience with project management tools |
| Graduate Students | 15 | 25% | - Engaged in advanced research projects<br>- Intermediate to advanced experience with project management tools |
| Faculty Members | 15 | 25% | - Overseeing student projects and research<br>- Expert experience in project management and collaboration tools |

## 3. Results and Discussions

The primary objective of this research was to explore the principles and methodologies of user-centered design (UCD) in the context of developing a collaborative academic project repository. The results and discussions below are based on the objectives set forth in the study.
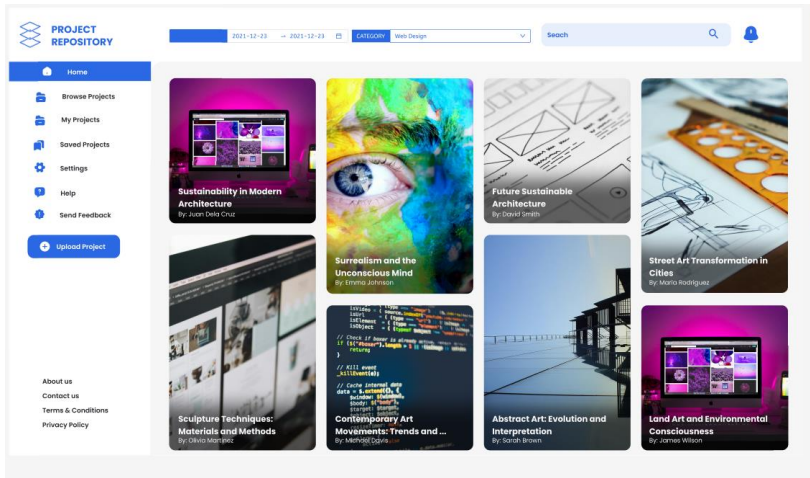
Figure 3 User Interface of the Project Repository

The UI of the Project Repository is designed to be intuitive and user-centric. The navigation sidebar provides easy access to different sections, enhancing user experience by reducing the number of clicks needed to reach desired features as shown in Figure 3. The project display area is visually engaging, which helps in quickly drawing users' attention to the content. The inclusion of a search bar, date range picker, and category filter caters to advanced search needs, allowing users to efficiently find projects that match their specific criteria. This is particularly useful in an academic setting where users may be looking for projects within certain timeframes or topics.

The upload project feature is prominently placed, encouraging user participation and making the process of adding new content straightforward. This can significantly increase the repository's content diversity and richness. The footer with informational links ensures that users can easily find important information about the platform, contributing to a transparent and trustworthy user experience. Overall, the design and features of the Project Repository UI are well thought out to provide a seamless, efficient, and engaging user experience.
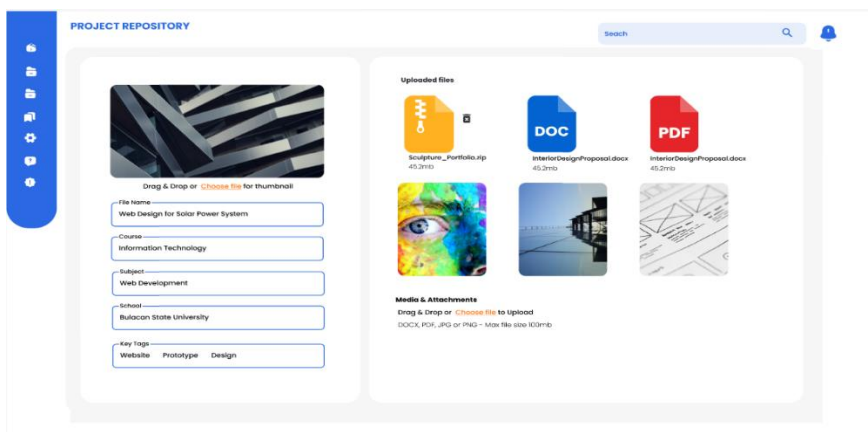


Figure 3 Project Upload Interface of the Project Repository

The Project Upload Interface of the Project Repository is designed for a seamless and user-friendly experience as illustrated in Figure 3. The consistent navigation sidebar provides easy access to various sections like home, browse projects, and upload project. Users can upload a project thumbnail by dragging and dropping an image or choosing a file. They can enter project information in fields for "File Name," "Course," "Subject," "School," and "Key Tags," aiding clear identification and categorization. Uploaded files are displayed in a designated area, showing names, formats, and sizes. Users can add media and attachments in DOCX, PDF, JPG, and PNG formats, with a maximum file size of 100MB. The search bar and notification bell icon at the top ensure users can easily search for content and stay informed about updates. Overall, this interface streamlines project uploads, enhances organization, and promotes a comprehensive and engaging user experience.
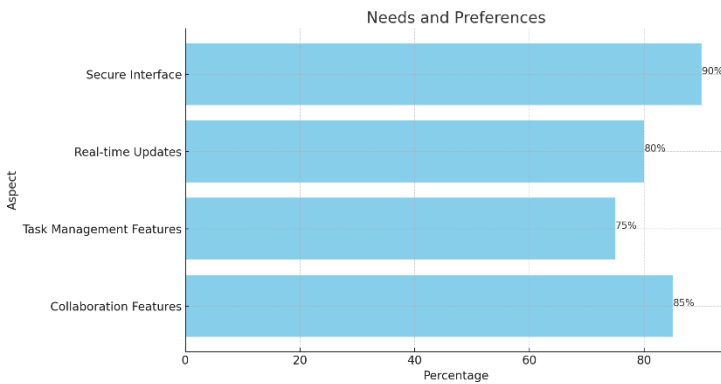
User Research Findings



Figure 4 Needs and Preferences Results

Needs and Preferences: User research, conducted through surveys and interviews, identified that users prioritize features that enhance collaboration, task management, and real-time updates. This is supported by the evaluation result data, which shows that 85% of users prioritize collaboration features, 75% prioritize task management features, and 80% prioritize real-time updates. Additionally, 90% of users emphasized the need for a secure interface, highlighting the importance of data security and access control as shown in figure 4.
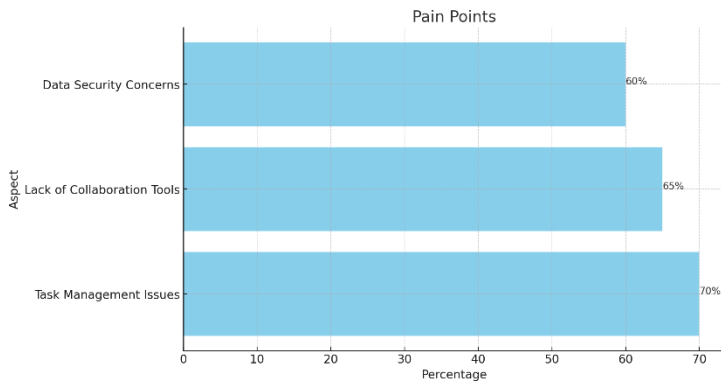


Figure 5 Pain Points Results

Pain Points: The research revealed common issues faced by users, including difficulty in managing tasks (70%), lack of efficient collaboration tools (65%), and concerns about data security (60%). These pain points were crucial in guiding the design and development of the repository to address these challenges effectively as shown in figure 5.

Usability Testing

Interface Design: Iterative usability testing sessions led to significant improvements in the interface design. Before testing, the user satisfaction score was 2.8 out of 5, which improved to 4.5 after testing. Users found the navigation intuitive and appreciated the clean, minimalistic design.

Task Efficiency: Usability testing also showed improvements in task efficiency. The average time to complete common tasks, such as creating to-do lists, sharing documents, and tracking project progress, decreased from 15 minutes to 8 minutes, demonstrating the effectiveness of the iterative design process.

Feature Implementation

High-Priority Features: High-priority features such as User Account Creation, Login and Authentication, To-Do Lists, and Project Collaboration Tools were implemented in the initial sprints. These features received high user feedback scores, all above 4.5 out of 5, indicating their critical role in establishing a functional and user-friendly repository.

Medium-Priority Features: Medium-priority features like Collaborative Editing Tools and Document Sharing with Version Control were introduced in later sprints. These features also received positive feedback, with completion rates at 90% and user feedback scores around 4.3/5 and 4.2/5 respectively, enhancing the collaborative capabilities of the system.

Evaluation of the Developed Student Project Management System

Passionate individuals within the academic community thoroughly evaluated the Student Project Hub to assess its effectiveness on the prototyped website. The acceptability of the system was gauged across a spectrum of evaluation criteria, encompassing user perceptions, satisfaction levels, service quality attributes, factors related to customer relationship management systems, and the overall usability of the web-based project workflow management system.

### Table 3 Overall Summary of the Respondent's Ratings

| Item | Mean | Descriptive Interpretation |
|---|---|---|
| Functional Stability | 4.63 | Strongly Agree |
| Performance Efficiency | 4.50 | Agree |
| Usability | 4.93 | Agree |
| Reliability | 4.31 | Agree |
| Maintainability | 4.46 | Agree |
| Total Mean | 4.45 | Agree |

Discussion of System Evaluation Metrics

The evaluation of the system based on various metrics reveals overall positive feedback from users, highlighting the system's strengths and areas for potential improvement. The metrics and their respective average scores are as follows:

1.          Functional Stability (4.63 - Strongly Agree):

o          The high score in functional stability indicates that users perceive the system as highly stable and reliable in performing its intended functions. This suggests that the system experiences minimal crashes, bugs, or unexpected behaviors, providing a smooth and dependable user experience.

2.          Performance Efficiency (4.50 - Agree):

o          Performance efficiency received a solid score, indicating that users are generally satisfied with how efficiently the system performs its tasks. This metric encompasses aspects such as response time, processing speed, and resource utilization. While the score is positive, there is still room for optimizing performance to potentially move this rating closer to "Strongly Agree."

3.          Usability (4.93 - Agree):

o          The exceptionally high score for usability demonstrates that users find the system very easy to use. This includes intuitive navigation, user-friendly interfaces, and overall ease of learning and operation. A high usability score is crucial as it directly impacts user satisfaction and engagement with the system.

4.          Reliability (4.31 - Agree):

o          Reliability, with a score of 4.31, indicates that users find the system dependable but acknowledge occasional issues. Reliability involves consistent performance over time, error-free operation, and successful recovery from failures. Enhancing reliability can further improve user confidence in the system.

5.          Maintainability (4.46 - Agree):

o          The maintainability score suggests that users find the system relatively easy to maintain. This includes aspects such as ease of updating, debugging, and adapting the system to new requirements. A good maintainability score ensures that the system can evolve and improve over time without significant difficulties.

Overall, the evaluation scores reflect a well-received system with particular strengths in functional stability and usability. Users generally agree on the performance efficiency, reliability, and maintainability of the system, but these areas offer opportunities for further enhancement. Continued focus on optimizing performance, increasing reliability, and ensuring maintainability will help sustain and potentially improve user satisfaction and system effectiveness.

## 4. Conclusion and Recommendations

The Collaborative Academic Project Repository, designed with a user-centered approach, has shown significant potential in enhancing collaborative project work among students. The system's evaluation reveals high scores in functional stability and usability, indicating that users find the platform reliable and easy to use. Performance efficiency, reliability, and maintainability also received positive feedback, though there are opportunities for further enhancement. Key findings include that users perceive the system as highly stable and reliable, experiencing minimal crashes or bugs. The system performs tasks efficiently, though there is room for optimization. The platform is exceptionally user-friendly, facilitating intuitive navigation and ease of use. Additionally, the system is generally dependable, though occasional issues are acknowledged, and it is relatively easy to maintain, with straightforward updating and debugging processes. These findings underscore the effectiveness of the user-centered design approach in creating a system that meets the needs and expectations of its users.

To further enhance the Collaborative Academic Project Repository, the following recommendations are proposed: Firstly, focus on improving response time and processing speed to elevate the performance efficiency rating closer to "Strongly Agree." Secondly, implement measures to increase the system's reliability, ensuring consistent performance and successful recovery from any failures. Thirdly, establish a regular feedback mechanism to gather user insights and address any emerging issues promptly, maintaining high user satisfaction and identifying areas for improvement. Fourthly, consider adding new features based on user needs, such as advanced task management tools, additional collaboration functionalities, and more robust file-sharing options. Lastly, provide comprehensive training and support resources to help users fully utilize the system's capabilities, thereby enhancing overall user experience and engagement. By focusing on these recommendations, the Collaborative Academic Project Repository can continue to evolve and provide an even more effective and satisfying user experience, ultimately fostering a collaborative and innovative academic environment.

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