



## User requirements and interface design for collaboration research applications using user experience design process

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**Abstract** — In conducting collaborative research involving more than one researcher, a system is needed that can improve the performance of researchers in various ways. This study captures the challenges faced by researchers in collaborative research and defines the requirements for collaborative research systems needed to address these challenges. From the analysis of the needs obtained, the researchers designed a collaboration application interface. Collaboration applications are needed to facilitate communication between researchers, search for articles, share publications, and other applications. The distribution of questionnaires and interviews was conducted to obtain the requirements needed for the development of a collaboration system. This research informs system developers to support the development of collaborative systems. In this study, the level of need for a research collaboration system in the university environment will be analyzed along with an analysis of its needs and the design of the user interface.

**Keywords** – application, collaboration, interface design, user requirement

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### I. INTRODUCTION

Research collaboration both within and outside the university is nothing new. Research that discusses the use of online communication and collaboration tools in the university environment has been widely carried out [1]–[3]. Previous studies have focused on the importance of online communication and collaboration tools in collaborative research in university environments, but have not focused on defining the prerequisites for obtaining requirements and designing interfaces for developing collaborative research applications.

While many online communication and collaboration tools already exist, they also create new challenges for managing, disseminating, and sharing research work [4]. A collaborative application is needed by a university for recording and tracking research in the university environment, especially independent research that is rarely reported. Libraries, research institutions, and information technology departments at the University can be facilitated by

a collaborative system to achieve best practices in research [2].

Identification of requirements is carried out to answer what questions researchers currently face in collaborative research, as well as what features are needed by researchers in a collaborative research system within the University [5]. One way to see user problems and needs in order to provide the best service is to meet requirements that please and satisfy users [6].

This study defines the requirements for a research collaboration system in a university environment and designs a user interface that fits the user's defined needs. This study aims to inform system developers to support the development of collaborative systems. This study analyzed the level of research collaboration system requirements in the environment along with the analysis of its needs and the design of the application interface.

According to the Big Indonesian Dictionary, work is the result of an act or creation (especially the result

of an essay). While scientific means being scientific, using common language so that it is easily understood by ordinary people (about articles, and the writing style of scientific works) [7].

Research writing and publishing scientific articles are academic activities carried out by any scientist or a technical researcher that helps demonstrate individual performance [8]. During their education in higher education, students will often be given the task of writing scientific papers in the form of papers or articles related to the course assignments they take. In addition, the skill of writing scientific papers is of course very important for students as one of the requirements for completing studies in tertiary institutions both at the bachelor to the doctoral education levels [9].

Collaboration is a translation of the word "collaboration" which means cooperation. Included in the collaboration are all activities that have goals and benefits to be achieved together. Collaboration in research or writing scientific papers is marked by the involvement of more than one author in the writing. The purpose of the collaboration is for writers to share knowledge and expertise from various fields of science. The collaboration of researchers from various different expertise can complement each other in solving problems so that the resulting scientific work is expected to be of higher quality.

Husna *et al.* [10] have conducted a similar research entitled Web-Based Writing and Editing Collaboration Application for Improving the Quality of Student Scientific Work, a case study at the Department of Educational Technology, State University of Malang. In this study, collaborative media was implemented for students of the Department of Educational Technology, the State University of Malang which has the features of creating scientific papers, listing publications, and sharing digital content in the student community.

In addition, Rahmawati *et al.* [11] have also conducted a study entitled "Efforts to Improve Scientific Writing Skills for Undergraduate Physiotherapy Students of Ums with Collaborative Methods in the 2012/2013 Academic Year". In this study, it was concluded that the collaborative method was applied by dividing students into groups to exchange and correct writing according to established guidelines.

Collaborative writing refers to a writing process in which a document is created by more than one author. A wiki is a tool that allows people to contribute, edit, and read content about a particular subject [12]. Wikis are collaborative writing technologies that can add, modify or delete content. The open nature of the wiki creates opportunities for group learning and reduces tutor workload [13].

The user experience design process is a process of increasing user satisfaction with a product by increasing usability, accessibility, and user satisfaction in their interaction with a product. User experience assesses how satisfied and comfortable a user is with a product, system, or service. In using a system interface, users sometimes experience difficulties during the interaction process. User experience focuses on functions outside the product when in direct contact or there is direct interaction with users [14].

The concept of usability is the basic concept of user experience (UX). Usability questions how well the user (users) uses a function, while utility questions whether a function stays within its principles. The use of applying all systematic aspects of human interaction including installation procedures and maintenance procedures. So usability and utility will be useful, which will question the level of usability of the entire information system, procedures, and functions of a mobile application in providing a new experience (experience) to the user when carrying out their activities. The questionnaire distributed in this study refers to user experience by dividing question groups into System Authorization and Performance, Analytical Capabilities, and Features and Appearance.

## II. RESEARCH METHOD

In this section, we discuss our research design, population and sample, and research framework.

### A. Research Design

The research method is the method used by researchers in collecting research data. By using the research method, it will be known that there is a significant relationship between the variables studied so as to produce conclusions that will clarify the picture of the object under study. The research method is basically a scientific way to get data with certain goals and uses [15].

The method used in this study is a qualitative research method with a descriptive research approach. In this study, the problem-solving being investigated is described, by describing or describing the current state of the object of research, based on the facts as they are.

This research was conducted at the North Sumatra State Islamic University (UINSU), Medan. The subjects of this study were lecturers and students of the Library Science Study Program, Faculty of Social Sciences, UINSU Medan. Research data was collected in the form of information about writing scientific papers. The research data were collected from various sources, namely lecturers, students, places, and events where the activity took place.

The techniques used for data collection include literature study, interviews, observation, questionnaires, and Focus Group Discussion (FGD).

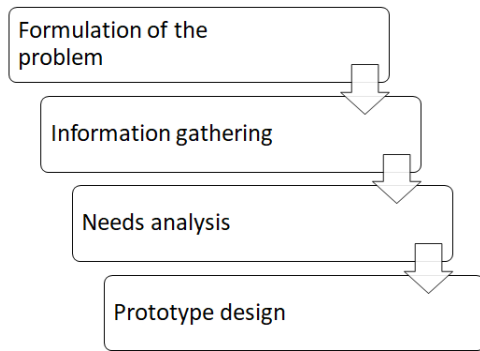


Fig. 1. Research framework.

The data analysis technique used to analyze the data that has been collected is the descriptive analysis technique. The data or information obtained in this study came from primary data and secondary data. For primary data, data collection was carried out by field observations, interviews, questionnaires, and Focus Group Discussions. Data and information obtained through literature study are data obtained from literature studies, scientific writings on collaborative applications, and comparative studies.

The process of analyzing user needs is carried out to obtain information about what important features are needed by users that must be in the application. Interviews were conducted with the lecturers and students of the Library Science Study Program at the State Islamic University of North Sumatra Medan before the developer designed and built a collaborative application.

Respondents to this questionnaire were 58 people consisting of lecturers and students of the Library Science Study Program at the State Islamic University of North Sumatra, Medan. Data was collected by distributing questionnaires to respondents online using the Google Forms application. The measurement scale uses a Likert scale with a scale of 1 to 5. The Likert scale is used to measure attitudes, opinions, and perceptions of a person or group of events or social phenomena [16]. The data tabulation process utilizes the Microsoft Excel application.

Focus Group Discussion/FGD is a data collection method that is often used in qualitative research. This method has the main characteristic of using interaction data generated from discussions among all participants. The advantage of this method is that it can provide more detailed, informative, and valuable data than other methods [17].

### B. Population and Sample

The population is the object or subject determined by the researcher who has certain characteristics. The population is determined to be studied and then conclusions are drawn [15]. The population in this study were all permanent lecturers of the library science study program totaling seven people, and the

2017 Library Science Study Program students totaling 93 people.

The sample is part of the population that represents the object or subject to be studied. This study uses the Slovin formula in determining the number of samples. This Slovin formula is commonly used in survey research where the population is quite large, so a formula is needed to get a small sample but can represent the entire population [18]. Below is the Slovin formula for determining the number of samples:

$$n = \frac{N}{1 + Ne^2} \quad (1)$$

Based on the above formula,  $n$  is the minimum number of samples,  $N$  is the population and  $e$  is the error margin. In this study, the degree of confidence is 90% or an error rate of 10% so the results of the calculation of the Slovin formula can be seen below:

$$\begin{aligned} n &= \frac{100}{1 + (100 \times 0.1^2)} \\ &= \frac{100}{2} \\ &= 50 \end{aligned} \quad (2)$$

From the results of the calculations above, it can be concluded that the minimum sample of the existing population for an error rate of 10% is 50 people.

### C. Research Framework

A brief explanation of the research steps is as follows:

- 1) The first step is to formulate the problem that occurs, namely the Library Science Study Program, Faculty of Social Sciences at UINSU Medan, currently does not have an online scientific writing collaboration community for both lecturers and students. The process of learning to write scientific papers that involve collaborative abilities needs to be proposed as a fundamental factor to be used as the basis for the scientific writing learning community.
- 2) Followed by collecting information that will be used as a reference in the application including selecting the framework/method to be used. Performing an analysis of the running system is very important to help determine whether the method to be used is suitable for the condition of the system.
- 3) The next step is to analyze the design needs of this collaboration tools application. This study analyzes the features that must be available in the collaboration tools application by looking for references and literature studies as well as through interviews and providing questionnaires to lecturers and students of the library science study program at UIN North Sumatra Medan.

- 4) Designing collaboration tools application interfaces that were developed using the User Experience Design Process to increase user satisfaction in interacting with products.

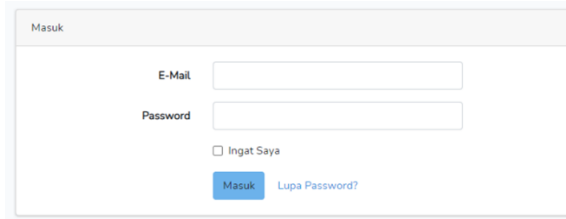


Fig. 2. Login form.

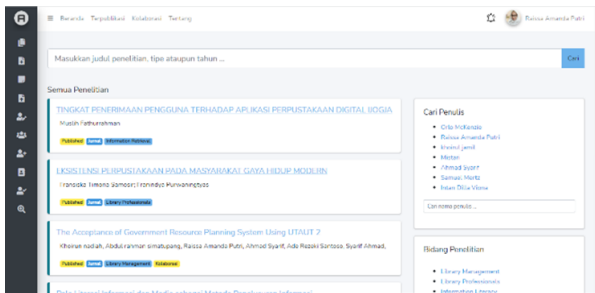


Fig. 3. Home page.

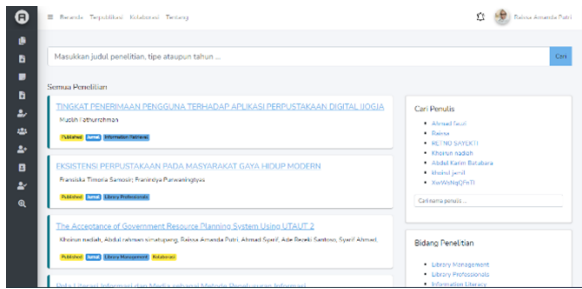


Fig. 4. All research page.

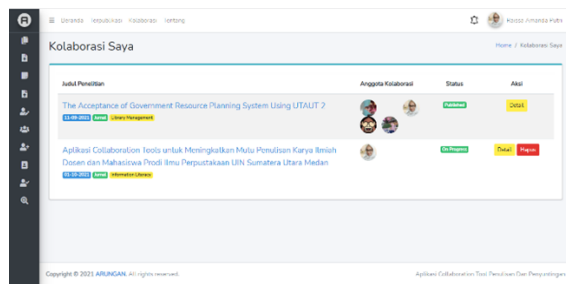


Fig. 5. My collaboration page.

### III. RESULT AND DISCUSSION

This section discusses the data description, questionnaire data analysis, the user needs analysis, and prototype design.

#### A. Data Description

The description of the data in this study is intended to provide an overview of the distribution of the questionnaires that have been carried out. The number of respondents who filled out the questionnaire in this study were 58 people.

Table 1. Data Description

Description	Total	Percentage (%)
Number of respondents who filled out the questionnaire	58	100
Number of unprocessed questionnaires	-	-
Number of questionnaires that can be processed	58	100

#### B. Questionnaire Data Analysis

This data analysis process uses descriptive analysis. Data were obtained from the results of questionnaires to lecturers and students which aimed to find out what features and functions they wanted to get from the collaboration application. Questionnaires are distributed before the developer makes the application. Processing of the data that has been collected using Microsoft Office Excel. NA for Not Agree, DA for Disagree, JA for Just Agree, A for Agree, and SA for Strongly Agree. The results of the analysis of the data that have been collected in this early stage are as shown in Table 2. It can be concluded that the system should be based on an authentication window so that users do not need to log on to the application many times (single sign-on) and there is a need for the user-level division to protect data integrity and limit user access to data. All respondents also agreed that the collaboration tools application to be built must have error handling messages if data input errors occur, easily recover after system downtime, and keep information up-to-date at all times.

Table 3 shows that users must be able to analyze information related to research publications, disciplines, collaboration and co-editing.

In Table 4 it can be concluded that a collaboration tools application is needed in which there are Single sign-on features, Error messages, List of research publications, Disciplines, Research collaborations, Joint editing (wiki), Add friends, Open Collaboration, Groups, Publication history, Share Folder, and Navigation menu.

#### C. User Needs Analysis

Based on the data collection carried out, a requirements analysis was carried out, namely:

- 1) An application is needed that can be used by lecturers and students to support collaborative research to improve the quality of scientific writing within the Library Science Study Program, UINSU Medan.
- 2) It takes an application in which there are features, namely single sign-on, error messages, list of research publications, disciplines, research collaborations, joint editing (wiki), add friends, open collaboration, groups, publication history and share folders.

Table 2. System Authorization and Performance

No.	Question	NA	DA	JA	A	SA
1	The system should be based on authentication window so that the user does not need to log on to the application multiple times (single sign-on).	2%	0%	17%	33%	48%
2	There is an error handling message if there is an error in data input, (for example: if you enter the wrong password or user name, an error message will appear).	0%	2%	10%	19%	69%
3	User Levels and Categories required to protect data integrity and limit user access to data.	0%	2%	16%	34%	48%
4	The system should perform very well at all times and should be easy to recover after system down time.	0%	0%	10%	16%	74%
5	The system must be able to keep information up-to-date at all times.	0%	0%	3%	19%	78%

Table 3. Analysis Ability

No.	Question	NA	DA	JA	A	SA
1	Users must be able to view research publications of lecturers and students.	2%	0%	10%	29%	59%
2	Users must be able to see the disciplines/research fields of lecturers and students.	0%	2%	7%	21%	17%
3	Users must be able to collaborate in writing research reports in real time.	0%	2%	19%	28%	52%
4	Users should be able to view the last co-edited file and its editing information.	2%	2%	24%	29%	43%

Table 4. Features and Appearance

No.	Question	NA	DA	JA	A	SA
1	Add a friend feature to follow other authors/researchers.	0%	3%	17%	26%	53%
2	There is an open collaboration feature to open opportunities for writers in the same field who want to collaborate.	0%	2%	10%	28%	60%
3	There is a group feature to add collaboration groups.	0%	2%	10%	31%	57%
4	There is a wiki feature for co-editing research in progress.	2%	3%	17%	40%	38%
5	There is a profile feature to register research fields and author's publication history.	0%	0%	19%	31%	50%
6	There is a share folder feature to store together the files used in the study.	0%	0%	12%	34%	53%
7	Users should be able to access data more easily and quickly.	0%	0%	9%	10%	81%
8	The system can adapt to new business processes and easily support future needs.	0%	0%	10%	28%	62%
9	Able to handle increasing complexity and number of requests without impacting system performance.	0%	0%	10%	31%	59%
10	There is a navigation menu that makes it easy for users to choose menus/features.	0%	2%	10%	22%	66%
11	System display must be consistent (menu and navigation do not change its position on each page).	0%	2%	12%	26%	60%

#### D. Prototype Design

When the user opens the application, the first display that appears is the login page. On this page the user can register a new account by pressing the register account button in the upper right corner of the display. Users who already have an account can fill in their e-mail and password as previously registered on the account list form and then press the login button. Users can also check the remember me checkbox so that the system saves the login information. This feature is in accordance with user needs, namely single sign-on, so users do not need to repeatedly enter their e-mail and password. On this page there is also a forgot password button that is connected to the user's e-mail.

Fig. 3 is the main menu view of the application or the home page. On that page there is a home menu to go to the main page, a published menu to view publications shared by users, a collaboration menu to view user research that opens up opportunities for collaboration and an about menu to view information about the application.

In addition to the menu bar at the top, there is also a navigation menu on the left side of the application. Below the menu bar there is also a search field. In this column the user can search for a list of research publications by entering the research title, type or year of research. In addition, on the right side of the main menu there is also a more detailed search

column, namely search by author name, list of research fields and type of research. On this page there is also a notification menu located at the top right which contains notifications to the user about the activity of the user and the user's friends.

The All Research page will appear when the user presses the navigation menu for all research in the research menu group. This page is useful for viewing research that has been published by all users, both belonging to users and friends and other users. Research information consists of research title, author's name, research status, research type, and year.

My collaboration page will appear when the user presses the My collaboration navigation menu in the research menu group. This page is useful for viewing, modifying and deleting collaborative user research. On this page, user research articles appear with information consisting of title, date of creation, type of research, field of research, collaboration members, and collaboration status, namely published or on progress. On this page there is also a details button to display collaboration details and a delete button to delete a collaboration. Only the primary author can delete a collaboration.

Fig. 6 is a collaboration detail page with on progress status. This page contains information about the latest activities of all collaboration members, research titles

that can still be changed, abstracts/descriptions that can still be changed, lead researchers, research members and supporting files that have been uploaded by all collaboration members.

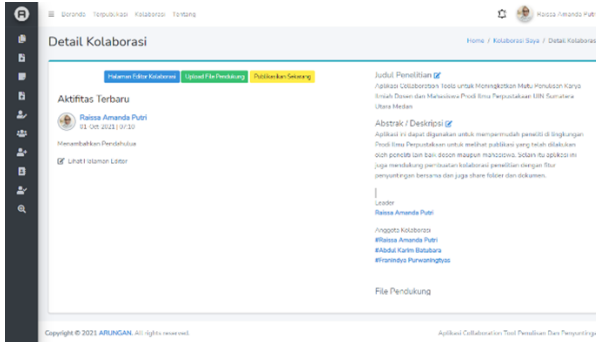


Fig. 6. Collaboration detail page.

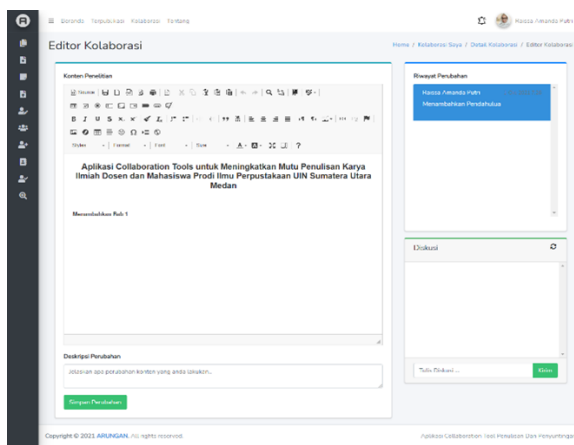


Fig. 7. Collaboration editor page.

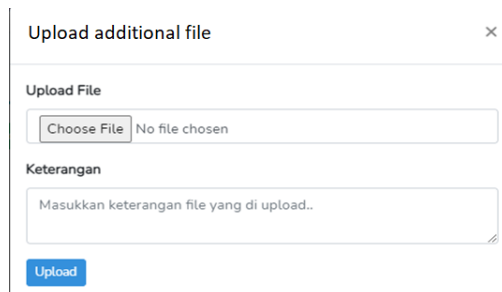


Fig. 8. Additional file upload form.

On this page there is also a collaboration editor page button, upload supporting files and publish now. The collaboration editor page button will direct the user to the editor page where the user can add, change, and delete content from the collaboration document. A support file upload button can be used by users to add files that collaboration members can share. The publish button can now be used by the user when the collaborative research has been completed and has been published. When the user presses the publish now button, the research status will change from on progress to published.

Fig. 7 is a collaboration editor page that will appear when the user presses the collaboration editor page button on the collaboration details page. On this page

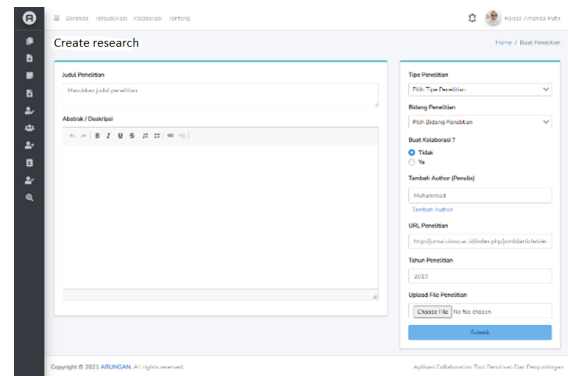


Fig. 9. Create research form.

the user can add, modify and delete the contents of the collaboration document. Before saving the document changes, the user must fill in the change description so that other research members know the document's change history and then the user can press the save changes button. On this page there is also information on the history of changes that have been made by all collaboration members and a discussion feature that facilitates collaboration members to exchange messages. Users can type the contents of the message in the write discussion column then press the send button.

When the user presses the upload support file button on the collaboration detail page, the upload form will appear as shown in Fig. 8. In this form the user can press the choose file button, then select a file in the open file dialog. Users can also add a description to the file and then press the upload button. Then the uploaded file will appear in the supporting file column on the right side of the collaboration detail page.

Fig. 9 is a display for the form for research/collaboration. This form is useful for users to fill in research data that has been published or research that will be used as collaborative research. In this form the user can fill in the research title, abstract, type of research consisting of papers, journals, theses and theses. In addition, users can also choose research fields consisting of library management, library professionals, information literacy, information retrieval, and information behavior.

If the user is going to create a collaborative research, then the user can choose yes in the question column for collaboration, but if the user wants to add research that has been published then the user can choose no. On this page the user must also fill in the author information, if there is more than one author, then the user can press the add author button under the author's name column. In addition, users must also fill in the research url, year of research and upload the research file. Users can press the submit button to save the data that has been filled in.

If the user chooses yes to the question for

collaboration, then the user does not need to fill in the research url, research year and upload the research file, but the user can choose to add members or allow collaboration requests. If the user chooses to add members, it means that the user directly determines who the collaboration members are and the user can directly select a research member in the search for members combobox.

If the user selects allow collaboration requests, then the user allows any other user to join the research collaboration. In this option, the research status will change to open collaboration and other users can apply to join the collaborative research that has been created.

#### IV. CONCLUSION

From the research that has been done, it can be concluded that a questionnaire based on user experience can be used as a reference in designing user interfaces for collaborative research applications. From the results of the questionnaire, it can be seen that the system built requires single sign-on features, error messages, a list of research publications, disciplines, research collaborations, joint editing (wiki), adding friends, open collaboration, groups, publication history, share folders, and navigation menu. Questionnaire questions can also be used in further research as a basis for obtaining user needs in making similar applications or modified according to the application to be made.

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