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Evaluation and Improvement of E-Grocery Mobile Application User Interface Design Using Usability Testing and Human Centered Design Approach

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Abstract

This study aims to determine the usability value of the e-grocery application interface design before and after repairs are carried out and provide recommendations for interface improvement designs using the Human-Centered Design (HCD) approach. The usability testing method and the system usability scale questionnaire are used to evaluate usability. The usability evaluation and design improvements to the e-grocery application have increased the effectiveness value of lower than 20% and an efficiency value of lower than 30%, with the task processing time needed by respondents being faster and improved by more than 900 seconds. And the value of satisfaction with the SUS score for the improvement design evaluation has increased, with a score difference of 30 points from the SUS score for evaluating e-grocery applications.

Keywords: Usability Testing, E-Grocery Application, Interface Design, Human-Centered Design.

1. Introduction

To increase user satisfaction, an application requires a good User Interface (UI) and User Experience (UX). Good UI and UX will help users get information according to their needs. However, to achieve this, it is necessary to plan from the start of the application. Good application design must design a UI that matches the expectations and experience of the user to generate positive feedback, which of course, will affect the usability of the application. To determine whether a product or application's UI and UX aspects are good or bad, usability values can be measured. Usability can be calculated based on the quality of the UX when interacting with systems operated by the users themselves [1]. Kiniku Trans is a self-help company founded by young people in Kalapanunggal District, Sukabumi, as a forum for young people to innovate and be creative in the digital world and develop the potential that exists in the region. Currently, this company has a mobile application-based digital product called Mall Kiniku. This object is an e-commerce application for buying and selling vegetables and traditional food specifically aimed at the people of Kalapanunggal District [2].

The results of an interview with the founder found that the e-grocery application's development took five months, and it began to be tested with the general public for about two months before being finally released on the Google Play Store. Until now, the application has been bug-fixed twice. The e-grocery application is specifically designed to help meet people's daily needs and also improve the economies of farmers and traditional food sellers [3]. He also said that in e-grocery applications, there are still bugs that often appear, and in the e-grocery application development process, there needs to be a usability evaluation process due to a lack of knowledge and human resources in this field. The usability evaluation process is essential even before the application, product, or service is realized to understand the needs and expectations of users. This is supported by other research saying that the basis of every positive UX has been defined when the application, product, or service is still at the conceptual level, even when there is no actual interaction between the application or development and existing users [4] [5].

On the OneSignal website, a service specifically designed for website or application developers that allows developers to provide notifications directly to users via push notifications and to abstract technical details such as the platform used by the user's device, as well as provide statistical information about the number of users based on the medium used [6]. E-grocery application statistics show that until now, the number of users who have installed the application was 210, and the number of active users was only 84. This number has decreased from September to November. Based on the previous description, it is necessary to evaluate the usability of the e-grocery

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application and improve its appearance so that users can easily understand the information on the e-grocery application and have an exciting experience. Using usability evaluation to develop a system can help identify areas for improvement and allow for process redesign based on user feedback. An important factor in usability evaluation is to focus on the user's point of view on the system and consider the system's user experience using the human-centered design approach [7].

This study uses the Human-Centered Design (HCD) approach to interface improvement. HCD functions to develop system interfaces that are more interactive and have benefits that focus on humans and their needs by using human factors, ergonomics, usability knowledge, and techniques [8]. This approach is used to improve usability factors, namely effectiveness, efficiency, and user satisfaction, and to avoid potential adverse effects on users [9]. The main activities carried out in this human-centered design (HCD) are understanding and specifying the context of use, specifying user requirements, producing solution designs, and evaluating methods against requirements. The design process in HCD is to design iteratively or repeatedly at each stage to find the design proposal that best suits the user and involves humans or users in the entire design and development process [10]. Several studies that have evaluated usability using the HCD and Usability Testing methods include assessing and designing the UI for the KRL Access application using the HCD and PSSUQ methods, which produce improved designs with a good level of usability with an effectiveness value of 100%, efficiency of 100%, and 98.75% satisfaction [11]. Furthermore, conducting research evaluating and improving the Jogo Tulungagung Astuti application interface using the HCD and SUS questionnaire methods, with the final test results indicating that the design improvement was good with an effectiveness value of 96.67%, efficiency of 94.47%, and satisfaction of 83 points. Finally, conducting evaluation research and designing user interface improvements in the KER application using the HCD and USE questionnaire approaches, with the study results in the form of a usability value of 85%, categorized as very good [12].

Based on this background, in evaluating e-grocery applications and improvement design prototypes, namely, using Usability Testing with the Think Aloud method and measuring the value of usability (satisfaction) using the System Usability Scale (SUS) [13]. The Think Aloud method is used to find out the user's opinion about the user's feelings when using the application. Providing task scenarios as part of the usability evaluation allows the user to express his thoughts, feelings, and opinions when interacting with the product [14] [15]. Usability Testing is done by providing a series of task tests to the user. Implementing Usability Testing aims to identify usability problems by collecting quantitative and qualitative data to determine user satisfaction with the product. The Usability Testing method is needed to determine the potential obstacles to using the application that users may face [15]. The results obtained in Usability Testing at the initial stage of the evaluation are then used as a guide in designing the next application interface prototype.

2. Research Methods

This research uses data collection methods: literature studies, observation, interviews, and questionnaires. In this step, the author will explain the stages of the process that will be carried out during the research period to make it easier for the writer to complete the research and get the expected results. The stages of the research carried out in this study were adjusted to the settings of developing the Human-Centered Design (HCD) method system. The research process starts with the data collection stage and ends with making conclusions and suggestions about the research being conducted. Understanding and specifying the context of use: at this stage, researchers try to understand and determine the context of using e-grocery applications. This stage begins with collecting data and information regarding e-grocery applications. The data needed is related to users and stakeholders, the characteristics of each user group, the tasks that each user group must carry out, and the system environment. The result at this stage is in the form of user characteristics and functions to be carried out by each user group that is formed personally. The results of the usability evaluation of the initial design of the e-grocery application are the values from the usability aspect, which includes parts of effectiveness, efficiency, and user satisfaction, as well as the usability problems users face. From the evaluation results, an analysis will be carried out to identify the specifications of the user's needs. The results of this stage are the requirements or constraints experienced by the user during the usability testing carried out in the previous step and suggestions for improvement submitted by the user, which will be considered in designing the proposed design. User personas are made based on the characteristics of each user, which have been obtained from interviews with five users. These characteristics are grouped to form a clear picture of the attributes of e-grocery application users. Data regarding user characteristics will be obtained by identifying the features of the respondents involved in this study. These characteristics are: age, current job, last education, and gender. This aims to determine the conditions under which users use the application. These data are used as the basis for designing e-grocery application proposals.

3. Results and Discussion

The results of observations made on e-grocery applications over the past four months found that the number of users actively using these applications fluctuated and generally remained stable at a low level. Observation

activities in the form of direct use of e-grocery applications continue to be carried out to see whether users can use e-grocery applications properly, and it is found that there are still many people who do not understand the features of these applications and the appearance of e-grocery applications is considered confusing. After identifying the users and stakeholders of the application, interviews were conducted to gather information about the context of its use, with five active users and one person from e-grocery. The results of this interview are used to create a description of the context of application usage. Determining the tasks required by the participants, based on the objectives of application development by stakeholders, will produce a report of the user's jobs. The e-grocery application aims to become a platform that can make it easier for people to meet their daily needs. The e-grocery application has features that can be used, such as buying products for everyday needs. Information about activities that users can carry out in the application is obtained from the analysis of the application.

A persona is created to understand and determine the user's needs and characteristics. Personas are used to understand user needs and know what they want and need. Personas can assist in designing products that meet the needs of everyone, not just the person creating the product. In human-centered design (HCD), this persona is included in determining the needs and characteristics of users or groups of users. The relevant characteristics of the users must be identified. User Personas are created based on data from interviews with five e-grocery application users. A user's user persona displays user information, such as the user's demographics, goals, behavior, frustrations, and needs. In evaluating the initial design of the system, usability testing is carried out to measure how easy it is to use the e-grocery application. Researchers will analyze the usability value for the interface's effectiveness, efficiency, and satisfaction aspects. Users selected to take the test will be given a series of tasks to work on. After doing this, respondents will be asked questions about what they did and how they felt while doing it. This information will be used as a reference in designing improvements to the application. Tests that involve five respondents allow us to find almost as many usability problems when compared to tests that involve more respondents.

When carrying out usability testing, respondents are asked to perform tasks related to the application, and researchers will make observations and records related to their behavior in interacting with the system. Each task to be carried out by the respondent is presented in the form of a task scenario. The results of the analysis revealed that the total number of respondents' comments was 65, with a percentage of 67.69% of which were negative. That is, a total of 44 negative comments and a total of 21 positive comments. This value is very bad because of the many negative comments given by users on the appearance of the e-grocery application for 10 task scenarios in the initial test. The results of calculating the effectiveness value of the e-grocery application on the test before the redesign is 80%. This value has exceeded the recommended average of 78%. Tasks two and nine were the ones most respondents could not complete. Efficiency results on the application before it was redesigned had an efficiency level of 77%. Efficiency measurement is said to be successful if the level of improvement after redesign is greater than that value.

User Requirements - This stage will describe the needs of e-grocery application users, based on data collected during the user research process. This will help ensure that the needs of e-grocery application users are met in the design and operation of the application. Producing the Design: At this stage, the user interface will be designed from low fidelity in the form of a wireframe to medium fidelity in the form of a prototype. Wireframe and prototype design using the Figma tool. The prototype will later be used to evaluate the results of the design recommendations that have been made by the author. Researchers create page wireframes to give an idea of how the app works before designing more detailed visuals. The results of this wireframe help to create a framework for the structure of the system. The wireframe that has been created does not use the full image or icon and has no color. The design of the e-grocery application's user interface (UI) is based on the design guidelines that have been made. Redesign is not done on every page of the application but focuses on things that can improve the user experience (UX) when using the application. Some elements are adjusted following the design guidelines.

The design improvements that have been made in the form of a prototype will then be tested for usability. The technical implementation of this second usability test is the same as the first usability test using the think-aloud method, with the same task scenario. The respondents involved in the second usability test were the same as in the first usability test, namely five people. This design improvement test is carried out in the same way as the first test, namely by analyzing user comments, and then these comments are grouped into two groups, namely positive comments and negative comments. The results of the analysis on the design improvement test showed that the total number of respondents' comments was 38, with a percentage of 76.31% being positive, namely 29 comments, and 23.69%, or 9 negative comments. These results have changed compared to the first test, where negative comments experienced a decrease in the number of comments with a decrease percentage of 44%. This value means that respondents are satisfied with the improved design of the e-grocery application, and with many positive comments, it means that the improved design is better than the current e-grocery application.

After the researcher has finished testing the improved design prototype with five respondents, the researcher will compare the results of the initial design evaluation with the results of the improved design evaluation. There are three factors that researchers will compare: effectiveness, efficiency, and satisfaction. The goal is to see which

design is more effective, efficient, and satisfying to users. After the respondents took part in the evaluation stage, both evaluating the current version of the e-grocery application and the improvement design on the effectiveness aspect, the results showed an increase in the value of effectiveness. In the current version of the e-grocery application, the total number of tasks that were successfully completed by respondents was 40 out of 50, while in the improved design, it had increased to 49 out of 50 tasks completed by respondents. And the effectiveness value of the current version of the e-grocery application is 80%. Meanwhile, in testing the value of the effectiveness of e-grocery applications, the improvement rate of effectiveness reached 98%. Based on these results, it appears that the level of effectiveness has increased by 18%. This increase was due to changes made to the layout of the application, which made it easier for respondents to understand. In addition, more representative icons and menus were added, which makes it easier for respondents to know what features the application provides.

The comparison of efficiency values between the current version of the e-grocery application and the improved design is measured by evaluating the usability of the two interface designs. The efficiency level of e-grocery application testing has increased significantly. In the initial test, the total time needed to complete the test was 1221 seconds. While testing the repair design, the total time required is 352 seconds. This shows that e-grocery design improvement applications are more efficient. In testing the value of efficiency, the repair design is different from testing the e-grocery application because, in the final test, the flow of carrying out tasks is simpler when compared to the initial test. A comparison of the satisfaction value between the current version of the e-grocery application and the improved design is measured through an evaluation using the System Usability Scale (SUS). The evaluation results show that the improved design results in a higher satisfaction value compared to the previous interface design. satisfaction value, or user satisfaction, in the initial evaluation and final evaluation, which is measured using the SUS questionnaire. Based on the results of the SUS calculation in the current version of the e-grocery application, a total SUS score of 250 is obtained, with an average SUS of 50 and the acquisition of a grade scale of F, which is included in the adjective rating category Poor. Meanwhile, the results of the SUS calculation for the e-grocery application Design Repair obtained a total SUS value of 400, with an average SUS of 80. and the acquisition of a grade of B, which is included in the adjective rating category Excellent.

4. Conclusion

The results of the usability evaluation of e-grocery applications using usability testing show that in the think-aloud results, the number of negative comments on e-grocery applications is 67.69%, or 44 comments, and 32.32%, or 21 positive comments. The usability value of the e-grocery application has an effectiveness value of 80%, an efficiency value of 77%, and a satisfaction value of 50%. With a SUS score of 50, this score is still below the recommended average score of 68. In addressing the problems faced by respondents, research This has resulted in eight recommendations for user interface improvements based on identified problems and user needs, such as adding product category features, the same product recommendation feature, and changing the menu language to be more consistent. Improvement design uses an HCD approach that is adapted to e-grocery application users. The results of the usability evaluation of the improved design using usability testing show that in the think-aloud results, the number of negative comments is 23.69%, or 9 comments, and 76.31%, or 29 positive comments. The usability value of the improvement design for the effectiveness value is 98%, the efficiency is 99%, and the satisfaction value with the SUS score is 80; this score is already above the recommended average of 68.

The comparison of the results of the usability evaluation of the initial design and the improved e-grocery application design is as follows: The effectiveness value of the improved e-grocery application design has increased by 18% compared to the effectiveness value of the current version of the e-grocery application. The efficiency value experienced a significant increase, with the difference between the two evaluations reaching 22%. In addition, the time spent on all tasks has also experienced a significant increase in efficiency. In the second evaluation, the five respondents only needed 352 seconds to complete the task, much faster than in the first evaluation, which required 1221 seconds. The satisfaction score of the SUS evaluation of the improvement design has increased, with a score difference of 30 points from the SUS score of the e-grocery application evaluation. In acceptability, the first evaluation is in the not acceptable category, while the second evaluation is in the acceptable category, and for the adjective rating, the first evaluation is in the poor category, while the second evaluation is in the excellent category. Limitations in this study are that the number of respondents involved only 5 people because the number of e-grocery application users is not many, but this number is enough to find problems. In satisfaction assessment using the SUS method with questionnaires made using Google Forms, and other limitations in research, this is design improvement design only until the prototyping process. In future research, it is recommended to measure usability by adding learnability and memorability values so as to provide a more comprehensive picture of the experience of using the application. In further research, other methods can be explored, such as user-centered design, goal-directed design, and lean UX.

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