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Usability Testing Design to Increase User Experience of a Mobile Landslide Application

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The necessity of usability testing on mobile applications built for landslide disaster management is discussed in this article. The design of user usability tests is critical to ensuring that the program is effective and efficient in catastrophic conditions, and the application's success greatly depends on its usability level. This research seeks to address user needs by designing a disaster mobile application. The goal is to address comfort issues when using disaster applications and provide the necessary solutions to improve their design and functionality by establishing user usability testing. In addition to identifying and solving usability problems that may occur when using disaster mobile applications, this research intends to establish a usability testing methodology related to landslide mitigation. The method of this study starts with research design, research procedures, data collecting, and analysis within several questions that relate to respondents who live in landslide-prone areas. The aspect of the usability test was assessed, such as connectivity, awareness, familiarity, easiness, usability, functionality, accessibility, error handling, and satisfaction. Using user usability test design in disaster mobile application development can boost the app's adoption and efficacy. Users who can easily access and use the application will have better access to emergency information and support. This study concludes that designing user usability tests is a viable method for improving the usability of disaster mobile applications. The findings revealed that user performance differed by group, with rescue workers being more efficient.

Keywords: *disaster mobile application, landslide susceptibility zones, usability testing.*

INTRODUCTION

The role of mobile applications in disaster management has grown. During a crisis, they can offer the general public vital information, including weather updates, evacuation routes, and emergency contacts. However, these apps' usability may impact how effective they are. Catastrophe apps' success heavily depends on how end users perceive their usability. Apps for disaster management must be created with the user in mind to be efficient and practical [1].

User usability test design is essential in creating catastrophe applications and ensuring the app is user-friendly and fits the needs of its intended audience. Before building the system, usability testing can help find significant design flaws. The foundation of effective systems' usability is a user-centered approach in which technology solutions are matched to the needs and

expectations of the user [2][26]. It's critical to comprehend how people see the usability of catastrophe apps. Usability in the context of catastrophe apps refers to providing components that successfully assist users in accessing crucial information and empowering them to make decisions during crises [1].

The issue in this aspect is the need for well-designed and user-friendly mobile applications to fulfill information and coordination demands during natural disasters. Despite the rapid advancement of information technology, there is always room for improvement in the usability and design of mobile applications that may be utilized efficiently in emergencies [3].

Depending on the accessibility and usability of current mobile applications on successful responses to natural disasters. The coordination, rescue, and transmission of information required by victims and rescue professionals may be hampered by inadequate apps. Research on user usability test design for catastrophe mobile applications is crucial to ensure the availability of valuable tools in emergencies [4].

Time and knowledge are crucial components that can prevent fatalities during natural catastrophes. In an emergency, it is essential to talk about and improve the usability of disaster mobile applications to give the public and first responders speedy and effective access to the information [5].

User usability tests should be carefully designed to solve issues. We can offer changes to improve disaster mobile applications by gathering information on user experience and addressing usability problems [6].

This research was done to ensure that mobile applications for emergency disaster relief work correctly and satisfy user needs. It will assist save lives and increase the effectiveness of disaster management. This research fills the gap by creating usability testing techniques appropriate for the catastrophe context and offering suggestions for modifications to improve disaster mobile application design. Usability tests will aid in bridging the lack of accessible, efficient instruments for disaster management. One of the research issues to address is how user usability test design can be implemented in the context of catastrophe mobile applications. What are the critical conclusions from assessing the usability of mobile applications for disaster relief, and How can the findings be used? Previous research has identified the importance of usability in disaster mobile applications. Still, only some have focused on designing user usability tests relevant to the disaster context.

The innovation proposed in this research is the development of usability testing methods that can be used effectively in the context of natural disasters. This research will also guide disaster mobile app developers to improve the usability of their apps [3].

Inviting people representing different user groups will test the usability of mobile apps for disasters. We will gather information on user experience and spot any potential usability problems. The findings of this study should help catastrophe mobile app developers make their apps more functional and high-quality in times of natural disaster.

Overall, this research is anticipated to significantly contribute to the drive to increase the efficiency with which mobile apps manage natural disasters and lessen the adverse effects of such disasters.

This study attempts to solve the issue of the need for more user-friendly and well-designed catastrophe mobile apps. The aim is to uncover usability problems when using such programs and give the necessary remedies to enhance their design and functionality by creating user usability testing.

In addition to identifying and resolving usability issues that might occur when using disaster mobile applications, this project intends to establish usability testing methodologies pertinent to the disaster environment.

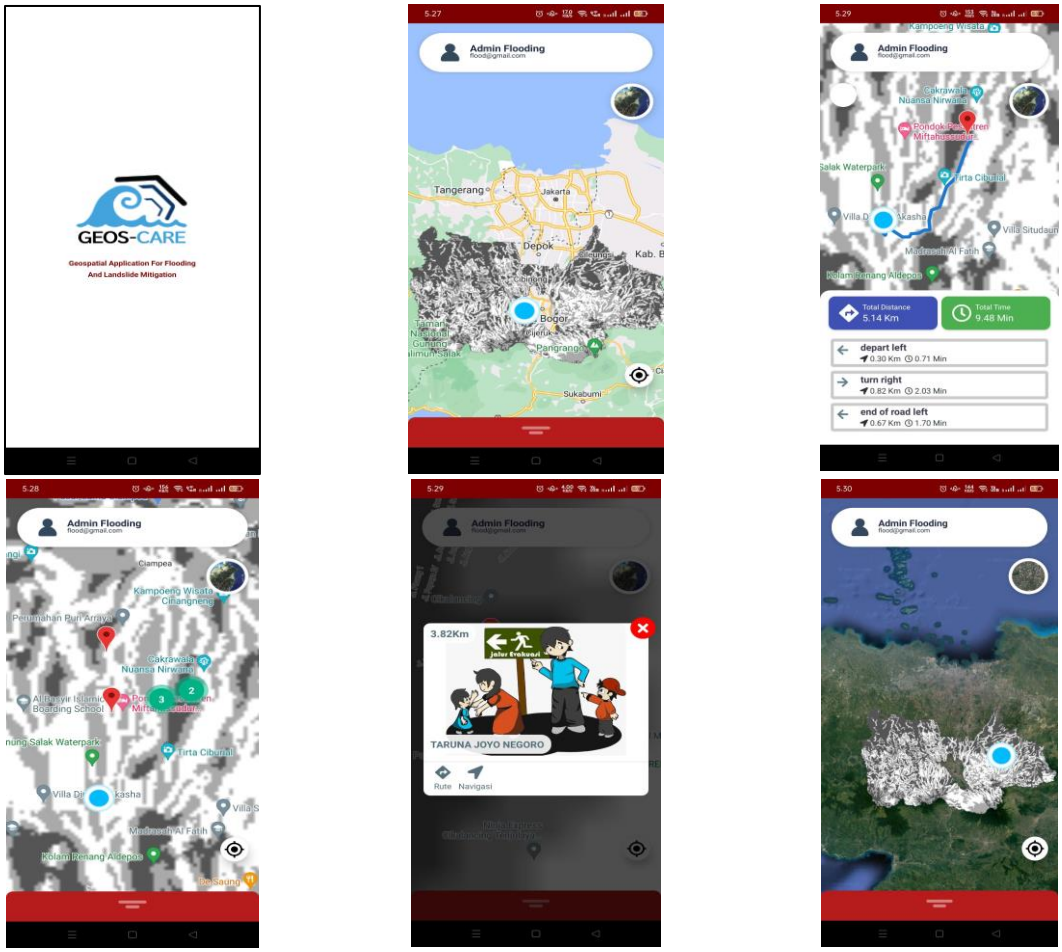

Figure 1. GEOS-CARE Android application features

This paper is a unit response to the application's testing. It continues examining approaches for predicting landslide susceptibility zones using a series of feasible data used as driving and triggering elements for landslides [7].

RESEARCH METHODS

Developing a list of queries about the usability of mobile apps, choosing participants who represent various user groups, particularly those who may be in the path of landslide disasters, designing test scenarios that invite comments and advice from experts, several queries, and measuring performance and user satisfaction are the methods that will be used in this study [8].

Research Design

The usability of catastrophe mobile applications is being tested in this study using an experimental research design. Because it enables better control over the factors influencing the results of the usability assessment, the experimental design was chosen [9].

Research Procedures

The research procedures carried out in this study included the following, the first is disaster mobile application selection. The selection of catastrophe mobile applications for usability

testing was the first step in this study project. The chosen apps should have the ability to be used in emergencies and be pertinent to the context of natural catastrophes [10]. The mobile application is GEOS-CARE, with the interface shown in Figure 1, which is currently operated on an Android base. The second step is respondents were chosen after considering several groups of possible users that resided in the hazard path, including disaster victims. Participants should have prior mobile application usage knowledge [11]. The third step is the designing of the questionnaire: a questionnaire with questions spanning several emergency scenarios was created to evaluate the application's usability. These scenarios involve duties that the responders must do, such as researching potential landslides, understanding the settlement's location, being aware of evacuation routes and meeting locations, or corresponding with authorities [12]. Table 1, as shown below, describes the formation of the question sets for the initial design of the questionnaire.

Table 1. Design of the questionnaire usability test

No.	Question
1	Name/Initial:
2	Address:
3	Gender: Man / Woman
4	Group of age: 17-40 years / 40-60 years / 60-70 years
5	Recent Education: No School / Elementary or Junior / Higher or Senior / Bachelor or Master or Doctorate
6	Residence: Permanent house / Tenament or Shack
7	Marriage Status: Not Married / Family / Widow or Widower
8	Occupation: Student or College / Farmers, Gardeners / Public or Private Officer / Businessman or Small Trader
9	Level of Familiarity with GEOS-CARE the disaster-mitigation mobile apps (After Installation): Familiar / Not Familiar
10	Level of User-friendly of GEOS-CARE visual design and layout: Worst / Good / Better
11	Level of Ease to use of GEOS-CARE the mobile apps: Very Easy / Easy / Difficult
12	Level of Acceptability of GEOS-CARE content layer information presented clearly and escape point and route understandably: Worst / Good / Better
13	Level of Acceptability of Error messages clear and helpful when GEOS-CARE went wrong (emerging): Worst / Good / Better
14	Suggestions for Improvement (Feedback) for GEOS-CARE: (comments)

The fourth step is testing the quality of the questions involved specifically chosen professionals with backgrounds in questionnaire development and statistical analysis, who evaluated the questions' quality and solicited feedback to help make the questionnaire better [13]. There were 20 experts involved with the initial queries that was posed to the experts are listed in Table 2.

Table 2. Design of the questionnaire expert judgement

No.	Question
1	Name/Initial:
2	Expertise:
3	Expert's View (Comments, Feedback, Improvement Suggestions) on Questionnaire

The fifth step is data collection for usability testing was done by respondents using the intended scenarios. Usability information is gathered throughout the test, including the time needed to accomplish the activity, error frequency, and user satisfaction [14]. Table 3, as shown below, provides an overview of the final set of questionnaire questions and has been adjusted based on expert quality testing.

Table 3. Design of the questionnaire usability test (revision)

No.	Question
1	Name/Initial:
2	Address:
3	Gender: Man / Woman
4	Recent Education: No School / Elementary or Junior / Higher or Senior / Bachelor or Master or Doctorate
5	Group of age: 17-40 years / 40-60 years / 60-70 years
6	Residence: Permanent house / Tenament or Shack
7	Marriage Status: Not Married / Family / Widow or Widower
8	Occupation: Student or College / Farmers, Gardeners / Public or Private officer / Businessman or Small Trader
9	Level of Network Connectivity when accessing GEOS-CARE Apps: Smooth / Sometimes smooth and sometimes slow / Slow
10	The knowing of the landslide-prone potential where they live in: Know / Don't Know
11	The using of mobile phone application to find information related to landslide-prone potential where they live in: Yes / No
12	The using of mobile phone for the following activities (If the previous answer is "Yes"): Search the internet for information on landslide-prone potential / Read news related to the landslide hazard posted / Knowing the nearest evacuation route in case of a disaster / Seek anticipatory measures in the event of a disaster
13	Level of Familiarity with GEOS-CARE the disaster-mitigation mobile apps (After Installation): Very Familiar / Familiar / Not Familiar
14	Level of Ease to use of GEOS-CARE the mobile mitigation apps: Very Easy / Easy / Difficult
15	Level of User-friendly of GEOS-CARE visual design and layout: Worst / Good / Better
16	Level of Acceptability of GEOS-CARE content layer information presented clearly and escape point and route understandably: Worst / Good / Better
17	Level of Acceptability of Error messages clear and helpful when GEOS-CARE went wrong (emerging): Worst / Good / Better
18	Level of Satisfaction of GEOS-CARE features to support landslide mitigation: Worst / Good / Better
19	Suggestions for Improvement (Feedback) for GEOS-CARE: (comments)

The sixth step is following testing of the participant interviews were done to learn more about their app-using experiences. The participants' opinions and comments were solicited using structured, open-ended questions [15]. Then preparing recommendations for enhancement. The following mobile application enhancement recommendations were created based on the findings of usability testing and interviews. This list includes changes to the interface's design, functionality additions, and suggestions for enhancing usability [16]. The last step is the implementation of improvements, the alterations to the mobile app for disasters are made after the suggested improvements have been accepted. It is possible to perform follow-up testing to confirm the successful changes implemented [17].

Research Subject

The research subjects consisted of various citizens of potential users of disaster mobile applications who live in the path of potential landslide disasters spread in almost all sub-districts in Bogor Regency, West Java Province, Indonesia. The selected data amounted to 132 respondents from villages recorded in the disaster areas (Figure 2).

Research Ethics

Confidential information, participant agreement, and data confidentiality are all examples of research ethical standards followed in this study. The study's goal and the participants' rights to participate were sufficiently explained to the participants. The information gathered will be safely preserved and utilized for the research [18].

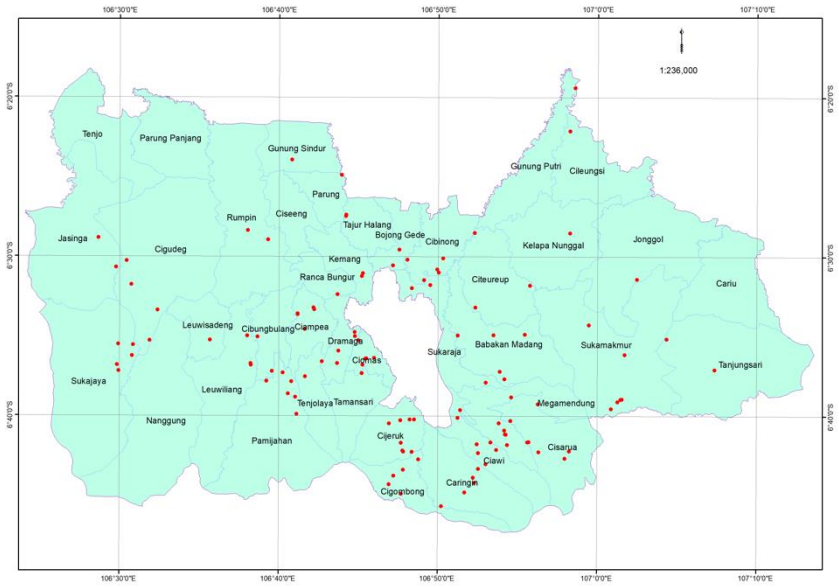

Figure 2. Map of respondents' distribution

Data Collection

Direct participant observation of users using the mobile application for disasters was used to get usability data. After testing, information was also gathered from individuals through structured interviews. The interviews were taped for additional examination [19].

Data Processing

Data processing stage by using quantitative analysis in specify with the descriptive analysis will be used to assess quantitative data, such as the time needed to accomplish the task and the number of errors. Then the thematic analysis of qualitative interview data will uncover patterns, themes, and participant ideas.

Data Analysis

Data analysis of usability data will be reviewed to discover usability issues developed during testing. The analysis includes determining the average task completion time, mistake rate, and level of user satisfaction [20]. Then the analysis of interview data will be qualitatively evaluated to detect common participant experiences and feedback trends. Emerging topics will be used to develop improvement recommendations [21].

There are various drawbacks to this study, such as the usability testing was done in a simulated environment rather than a real-life crisis, the participant sample may not entirely represent the diverse groups of potential consumers, and while this test focuses on usability, it may overlook other factors, such as program security and stability [22].

RESULTS AND DISCUSSION

Expert Judgement

This stage describes about the summary and the opinion from experts. The 20 statisticians come from various backgrounds, with three socioeconomic statisticians, five environmental statisticians, five spatial statisticians, and seven engineering statisticians among them. The specialists have multiple levels of education, including professor, doctoral, and master's

degrees. In terms of the expert opinion, some of the expert assessment's findings can be stated as follows: the suggestion of adding a description of community characteristics related to the type of mobile device they use, an indication of improving community characteristics by including information on whether the community had ever gained knowledge about landslide disaster mitigation, the suggestion of adding network connectivity questions when accessing the application, the direction of changing the value range to make it easier for users to choose answers, the guidance of further accrediting when something went wrong, error messages were clear and helpful.

There was a recommendation to add access to information and literacy to the application. Table 3 shows the changes made to the questionnaire questions based on the experts' feedback.

Usability Assessment

The social condition of the participants describes such the 132 respondents comprised 73% males and 27% females with an education level of 61% high school, 33% elementary to junior high school, and the remaining percentage did not attend school or graduated from university. 67% of the respondents were aged 40-60 years, while 31% were between 17-40 years, and the rest were 60-70 years. Looking at the condition of the houses, 93% of the respondents have permanent homes, while the remaining 7% are tenements. Based on family status (marriage status), 94% of respondents have a family, while the remaining 6% do not have a family. Regarding occupation, 42% of respondents are small traders, 28% work as farmers or planters, 25% work as government and private officers, and the rest are unemployed or college students.

For the usability test based on the Level of Network Connectivity when accessing GEOS-CARE Apps, 69% of respondents experienced internet connection instability, and the remaining 31% had a smooth connection. Based on knowing the landslide-prone potential where they live, 83% of respondents see the information, and the remaining 17% do not know the potential disaster. As many as 81% of respondents have used mobile phone applications to find information about landslide-prone potential where they live, and the remaining 19% do not use mobile phones. Respondents use mobile phones more to seek anticipatory measures in the event of a disaster, read news related to the landslide hazard posted, and search the internet for information on landslide-prone potential. After respondents were asked to install GEOS-CARE mobile apps, 83% claimed to be familiar with the application, and 14% of respondents experienced unfamiliarity. GEOS-CARE Mobile Apps were perceived as easy to use by 92% of respondents. In general, 87% of respondents were satisfied with the information services on landslide potential and mitigation issued by GEOS-CARE. In general, the description of the usability test aspects is shown in Figure 3.

In previous literature, similar studies have revealed that the usability of disaster mobile apps remains a challenge. Our findings are consistent with previous studies showing that users, especially disaster victims, face difficulties using disaster mobile apps during emergencies. Similar studies in the past have demonstrated that the usability of catastrophe mobile apps remains a concern. Our findings are consistent with earlier research that shows that users, particularly disaster victims, struggle to use catastrophe mobile apps during emergencies [23].

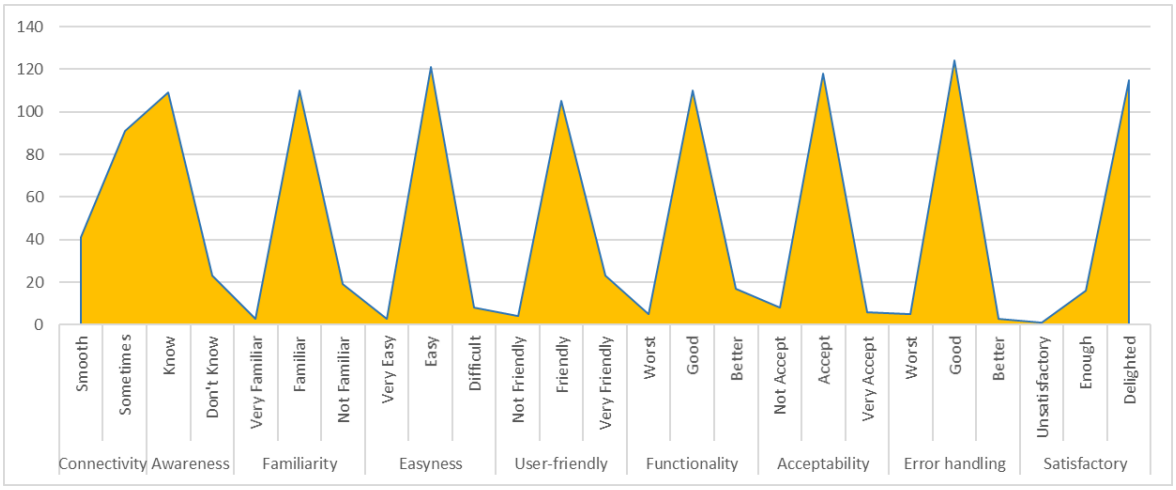

Figure 3. Resume of usability test

An unanticipated finding in this study was a relatively high frequency of errors, particularly among catastrophe victims and other associated parties. Although user happiness has increased, the number of errors indicates a potential issue that could impair the app's usage in emergencies. As a result, particular care must be taken to improve the app's design [24].

The findings are consistent with past research indicating that catastrophe mobile app usability remains difficult. The results show a need for usability improvement, particularly for catastrophe victims and other stakeholders.

These findings will substantially impact the development of catastrophe mobile applications. The lower average reaction time of rescue respondents suggests that the app can be used effectively in emergencies requiring a speedy response. The high level of satisfaction also implies that customers believe the app adequately serves their needs. The result is better disaster management efficacy, which can lessen the negative impact on victims and speed up the response of rescue personnel [25]. With a series of processes to form the question set in the questionnaire, including expert testing, the author believes that it is feasible enough that it does not require additional effort to use the System Usability Scale (SUS).

CONCLUSION

Using user usability test design in disaster mobile application development can boost the app's adoption and efficacy. Users who can easily access and use the application will have better access to emergency information and support. This study concludes that designing user usability tests is a viable method for improving the usability of disaster mobile applications. The findings revealed that user performance differed by group, with rescue workers being more efficient. Despite high satisfaction levels, usability enhancements are still required to ensure the app can be utilized effectively in emergencies. First, this study discovered that disaster mobile app users fall into three categories: disaster victims, rescue professionals, and other relevant parties. These data suggest that user capabilities and demands differ, with rescue workers being more skilled in using this type of program. Second, the usability testing findings revealed that the average time it took different user groups to complete the testing activities differed. On average, rescue workers took less time to complete the tasks, demonstrating that those trained in emergencies utilize the app more efficiently. Meanwhile, catastrophe victims and other interested parties need more time, indicating a potential usability issue. Third, all user groups report high levels of satisfaction. It shows that people believe the software satisfies their

needs well. However, the data also indicated major mistakes among catastrophe victims and other parties. It implies that there is still potential for development in terms of usability. Fourth, a comparison with previous literature reveals that our findings are comparable with usability issues found in earlier catastrophe mobile app studies. It highlights the importance of improving the design and functionality of such programs. Fifth, the report recommends changes to user interfaces, process simplicity, and additional training for potentially challenging user groups. These approaches are projected to improve the usability of catastrophe mobile applications in emergency scenarios, increasing the effectiveness of natural disaster response.

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