Toward Sustainable Biodiversity Conservation Integration Technology and Nature through the AkarJaga Application for Exploring Indonesian Flora

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Abstract. Indonesia has a wide variety of unique flora that needs to be disseminated to the Indonesian people themselves. However, more than 80% of Indonesia's forests have been razed to the ground. As a result, many endemic species whose habitats are endangered. This research aims to develop the AkarJaga application that contains knowledge about various kinds of Indonesian flora which can later help the community to help preserve endemic flora that are almost extinct. The AkarJaga application was built using Firebase software to display the real form of the application. The methodology used in designing the application in this article is the Multimedia Development Life Cycle (MDLC). There is a testing phase where this application is tested by involving quality evaluation which includes usability and functionality measurements. Usability testing is done using the Unmoderated remote usability testing and Blackbox testing method approaches. The test result data is presented using the System Usability Scale method. Through ten questions asked to the test respondents, the final System Usability Score (SUS) is 84.78 with a Very Good rating, which means that this system is acceptable.

Keywords: Indonesian Flora Application, AkarJaga, Multimedia Development Life Cycle, System Usability Scale, Blackbox Testing.

1. Introduction

Indonesia has diverse natural resources. One of them is flora, which is widespread in the territory of Indonesia. Each region must have flora with different characteristics. An interesting fact is that Indonesia is one of the countries with the highest biodiversity in the world. Indonesia is an island country consisting of more than 17,000 islands [1], spread around the equator and located between the Indian Ocean and the Pacific Ocean, with an altitude of up to 3,000 meters above sea level. This

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provides opportunities for the growth of various types of plants that become rich and priceless natural resources. Indonesia's flora is rich with more than 30,000 plant species, which is estimated for 10% of the world's flora. Most are native to the archipelago, and the others are endemic to Indonesia or endemic to the island where the plant is located and grows [2].

Indonesia ranks fourth in the world in terms of plant species, with more than 25,000 species of flowering plants [3] Despite it is floristic richness, many plant species in Indonesia face serious threats from deforestation, climate change, and other human activities that can damage natural resources. More than 80% of Indonesia's forests have been cut down, threatening the survival of many endemic species that live in forests that have been razed to the ground [4]. This threat can lead to the extinction of some endemic species whose existence is only left in the world.

Technology today has a fairly fast and rapid development. One of the real examples today is the integration of telephone communication media on a device. In this developing era, many people use gadgets. Not only to communicate, devices can present various information by simply typing one or two words. Android is a mobile device system that is growing rapidly at this time. This is because the technology is Open Source so developers can create their applications, and a lot of support from various other technologies. Indonesia has very diverse natural resources. One of them is the flora that is widespread in the territory of Indonesia. Every region in Indonesia must have flora with different characteristics. An interesting fact about Indonesian flora is that Indonesia is one of the countries with the highest biodiversity in the world. Some of the problems found in existing mobile applications include unattractive user interface design, lack of appropriate content to explain endangered flora, and sound settings, therefore this paper discusses the development of an application that is almost similar to an encyclopedia called AkarJaga [5].

Digital technologies such as mobile phone applications can play an important role in biodiversity conservation. The application that we will create can help document, identify, and study local flora, as well as increase public awareness of the importance of preserving the environment [6]. It is hoped that our application will be able to help people find information about flora. Later, users can find various kinds of information about flora including types, Latin and common names, care tips, and others. Based on the background that has been revealed above, the title of this article is “Indonesian Flora Exploration: Integration of Technology and Nature in the AkarJaga Application”. So we conclude that we will make an application-based introduction to Indonesian flora to help people increase knowledge and make it easier to find information about the flora in Indonesia [7].

2. Method

The methodology used in writing this article is the Multimedia Development Life Cycle (MDLC) as a development methodology, usability testing using the

Unmoderated Remote Usability Testing method with testing applied through the Maze Design website and the System Usability Scale (SUS) method as a testing method to obtain a usability score.

Multimedia Development Life Cycle was chosen as the methodology in writing the article because it provides a systematic writing structure, includes detailed stages, and allows a real depiction of the development process. Unmoderated Remote Usability Testing was chosen because this method can be done without having to monitor the testers directly, and the implementation through the easy Maze Design website helps the testing process run smoothly and without problems. System Usability Score is one of the many testing methods used to test software functionality by displaying systematic calculations. Then paired with Blackbox testing which serves to strengthen the calculation results obtained from the System Usability Score calculation method.

2.1. Multimedia Development Life Cycle

This method implements six stages that include concept, design, material collecting assembly, testing, and distribution [8]. Illustration of the Multimedia Development Life Cycle Method Steps can be seen in Fig. 1.

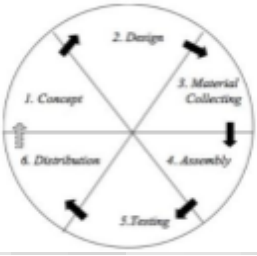

Fig. 1. Multimedia Development Life Cycle Method Steps

2.1.1 Concept

The output of this stage can be a narrative document to reveal the objectives of the project to be achieved, or it can be a description of the design needed for multimedia applications such as UML diagrams and the like. Anything created must have a purpose. AkarJaga aims to preserve or protect Indonesian flora, which includes public understanding of the richness of Indonesian flora. AkarJaga can help preserve a flora by organizing productive challenge features such as “Planting Roots”. It can maintain and multiply the types of flora that live in Indonesia. Of course, this feature adjusts to the conditions in the environment around the user.

The AkarJaga application helps people increase their knowledge about flora in Indonesia with digital assistance. People can easily access the AkarJaga application anytime and anywhere using their devices. We created a simple interface so that

users can easily access the features we provide. The flora search feature will encourage people to deepen their knowledge of Indonesian flora which has various characteristics. This application is equipped with a community feature that makes it easy for users to communicate with fellow AkarJaga users. Users can discuss hobbies, planting tips, care tips, seedling recommendations, and so on in the community feature. In addition, the community feature allows users to share their experiences and knowledge about Indonesian flora, namely:

1. Richness of Information
   The AkarJaga website succeeds in presenting rich and useful information about Indonesian flora. Detailed descriptions, high-quality images, and plant care tips make this website a valuable resource for nature lovers and researchers.

2. The Importance of Conservation
   Through the information presented, this website successfully conveys the importance of preserving Indonesian flora. Users are given an understanding of Indonesia's rich natural diversity and how they can contribute to its conservation efforts.

3. Conclusions and Recommendations
   Overall, the AkarJaga website is a valuable resource for nature lovers, researchers, and the general public who wish to expand their knowledge of Indonesian flora. Recommendations for further development include improving interactive content, developing community features, and expanding the existing plant database.

The Discussion section describes the implementation that has been done in the research as well as the testing done at the implementation stage. Implementation produces the interface of the AkarJaga application. Functionality testing is done through questionnaires (number of respondents) to get usability testing results using SUS. These stages will be explained in the following subchapters in detail.

2.1.2 Design

The design stage is the stage of making project specifications including architecture, style, appearance or interface, as well as the selection of materials needed. Specifications are made as detailed as possible in order to meet the needs of the application without discussing new decisions at a later stage. The initial stage in making an application is to research everything that is needed in the application. In the design section, we start to create a workflow for this application so that the project we make can run according to plan. Illustration of the workflow can be seen in Fig. 2

Fig. 2. Workflow Design

After the workflow, we create an ER Diagram to design a database creating an ER Diagram. ER diagrams are related to data structure diagrams that focus on the relationship of elements within each entity, not the relationship between the entities themselves. The following ER Diagram is in the form of a table that already has a relationship between attributes. Illustration of the ER Diagram can be seen in Fig. 3.

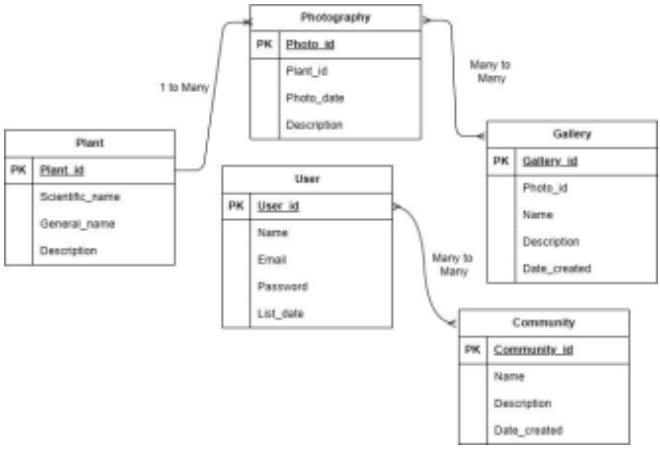

Fig. 3. ER Diagram

2.1.3 Material Collecting

Material Collecting is the stage of collecting any multimedia materials needed in the program [9]. The materials needed in the application interface are objects such as 2D images, icons in the application, buttons, fonts, and other materials that support the appearance of the system.

2.1.4 Assembly

The assembly stage is the stage of creating objects and materials for the entire multimedia material based on the previous stage. At this stage, we select all the materials that have been collected again before entering into the implementation according to the needs of the application. The Design of AkarJaga was created using Figma. We choose Figma as the tool to visualize AkarJaga because Figma allows us to build feature-rich collaborative applications.

2.1.5 Testing

This testing stage will be carried out after the assembly stage is complete. This stage serves to see whether there are errors or not while using the application. We use the unmoderated remote usability testing method. Data collection in testing uses the help of google forms.

2.1.6 Distribution

At the distribution stage, the application is stored into the storage media after going through the testing process. This application is installed on the device OS and can only be accessed by registered AkarJaga users.

2.2. Unmoderated Remote Usability Testing

Unmoderated remote usability testing is a testing process that is carried out without direct supervision. The testers can test from anywhere using their own devices. The tester will ask specific questions. This is useful to fulfill the purpose of creating an application or web created. This test is used to verify that the functionality of the software interface runs properly, accepts input properly, and produces the correct output. Unmoderated remote usability testing provides not only a much larger pool of users but also allows those users the flexibility to participate from their natural working environment or location [10].

2.3. System Usability Scale Testing

System Usability Scale (SUS) is an evaluation method used to assess the usability of a product, application or system. There are ten questions used in the system usability

scale (SUS) method approach. The assessment in this method consists of three aspects, namely acceptability, grade scale, and adjective rating.

2.4. Blackbox Testing

Behavioral Testing or commonly called blackbox testing is a test that aims to observe the input and output of the software without looking at the code structure of the device being tested. Blackbox testing is done after the application is usable but has not been distributed to potential users. This is done to find out whether the software functions can run properly or not.

Overall, black box testing helps the functionality to be validated by the system. Black box testing is done based on the perspective of the end user. The purpose of black box testing is to handle valid input and invalid input from the customer [11].

3. Result and Discussion

At this stage some of the things described are the implementation stage and also the testing stage. The implementation stage contains the Akar application interface. The testing phase is carried out with the unmoderated remote usability testing methodology and the system usability scale.

3.1. Implementation

The implementation stage displays the interface of the AkarJaga application function. The overall implementation of the application has been carried out. In the picture below there is a list page, login page, navigation bar, search column, flora gallery, community, and profile which are the main functions of this application. Illustration of the implementation of AkarJaga can be seen in Fig 4.

Fig. 4. Implementation of AkarJaga

3.2. Testing

In this research, the testing stage of the AkarJaga application was carried out using the unmoderated remote usability scale method to test the interface, System Usability scale (SUS) testing to assess the app system.

3.2.1 Unmoderated Remote Usability Testing

In this remote test, we checked the function of each button, icon, and image. When testing, we give directions at each stage in detail so that testers can carry out testing in a structured manner. We use the help of a maze website as a usability testing media.

Table 1. Task and Testing Scenario of AkarJaga Application

Task Number	Task	Testing Scenario
T1	Sign-up or Login	Press or tap the Sign-up or login button to enter the designated page.
T2	Search for the Plants You Want to See	Press or tap the search field to go to the specified page. Then tap or tap the flora listed on the page. Finally tap or tap "Care Tips".
T3	View Gallery Page	Press or tap the gallery icon on the navigation bar to go to the specified page. Then select one of the flora listed on the page. Press or tap "edit" then "save".
T4	View Community Page	Tap the community icon on the navigation bar to go to the specified page. Next tap or tap the search bar until it displays the community groups. Tap on the "Pemuda Labil" community group. Finally tap or tap the "Join" button to join.
T5	Edit Profile	Press or tap the profile icon on the navigation bar to go to the specified page. Next, press or tap the button "Edit Profile".

Table 2 contains the results of the values obtained from usability testing using the maze website. The score obtained is the average result of all tests for each task. Results are obtained in detail from testing each task.

Table 2. Report of the Prototype Test

Scenario	Direct Success	Mission Unfinished	Total Tester	Missclick Rate	Average Duration	Usability Score
T1	100%	0%	33	39,4%	16,9s	85
T2	68%	24%	25	36,7%	59,5s	61
T3	78,9%	5,5%	19	25,3%	20,6s	79
T4	84,2%	5,3%	19	39,5%	24,6s	79
T5	83,3%	5,6%	19	28,8%	28,8s	85

Usability score in the table is an average calculation based on the number of testers on each task. The data transferred into the table is accurate data obtained from the testers' answers to the tested functions. Based on table 2, the results of application testing show varying results. “Sign up or login” had a usability score of 85 indicating user difficulty. Although part of the task is completed, the click error rate is still quite high (39.4%) and the average duration is quite long (16.9s) indicating the interface is quite efficient and for the number of people who do the tester is 33. On “Find Plants” has usability testing 61 indicating user difficulty, then the click error rate is at 36.7% the lift is still quite high with a long average duration (59.5s) indicating users are somewhat confused in finding a plant search engine with the number of testers 25 also the mission is not completed at 24%. On the “Gallery Page” has usability testing at 79 indicating users have difficulty in searching, for the click error rate is still quite high (25.3%) as well as a long duration of 20.6s indicating users have difficulty finding the gallery page icon, for the number of testers at 19 and missions that are not completed around 5.5%. On the “Community Page” has a usability testing number of 79, has an average duration of 24.6s this figure is slightly higher than the previous page which means that users take quite a long time to find the community page, also has a click error rate of 39.5% indicating that users still have difficulty finding the icon for the community page. On “Profile” shows a usability testing result of 85 this figure is slightly higher than before but has a higher time duration than before (28.8s) meaning that users take a long time to find the profile icon [12].

3.2.2 Blackbox Testing

At this stage testing is carried out on every important function in the AkarJaga application. There is a table that contains information on the object being tested, a description of the test text, and the results obtained successfully or not. Complete blackbox testing information can be seen in table 3.

Table 3. Table of Blackbox Testing Stages

Picture Object	Object	Test Description	Result Obtained
	Sign up button	Press will display the information to register.	Successful
	Login button	Press will display information to login by filling in the username and password column.	Successful
	Search bar	Press and write what you want in search bar and it will the page will display the information you are looking for.	Successful
	Plant pictures (search bar)	Press will display some information on the plant searched for.	Successful
	Gallery icon in navigation bar	Press will display some picture of plant that have been saved by the user.	Successful
	Plant collection	Press will display complete information about plant that has been saved by the user.	Successful
	Icon plus (+) on gallery page	Press will display form for users to fill if they want to enter the plant information to be saved.	Successful
	Community icon in navigation bar	Press will display one or more communities that the user has select before.	Successful
	Community chat rooms	Press will display a conversation of several people who	Successful

		have joined the chat room.	
	Profile icon in navigation bar	Press will display some personal information about the user.	Successful
	Home icon in navigation bar	Press will display a home page of the application after login or sign up.	Successful

3.2.3 System Usability Scale

SUS testing methodology is one of the testing methodologies used to test the usability of this AkarJaga application. The questionnaire was created and distributed by Google Forms to be assessed by respondents by answering ten questions organized by the selected method, each of which has a scale of 1 to 5. The target community who tested this application were flora experts, scientists, flora lovers, and teachers. The questions given to the testers amounted to 10[13] in accordance with the provisions of the SUS methodology:

1. I find it easy to login/sign in.
2. I found it easy to understand the homepage.
3. I found it easy to find the plants I wanted to look for. (according to the instructions on the maze)
4. I found it easy to view my digital flora on the gallery page. (according to the instructions on the maze)
5. I find it easy to communicate on the community page. (according to the instructions on the maze)
6. I found it easy to view and change my profile. (according to the instructions on the maze)
7. I found it easy to view pages other than the homepage by simply pressing the navigation bar button. (according to the instructions on the maze)
8. I find it easy to understand the app interface.
9. If I have a hobby and interest in flora in Indonesia, I will use this app to fulfill my hobby.
10. I would recommend this app to people who love Indonesian flora.

At this stage questionnaire data processing was carried out using the SUS method for 35 respondents. In collecting data, the average SUS score is calculated with the calculation rules, namely odd value minus 1 and even value, minus 5. Because of that, it is multiplied by 2.5 to get the score, as well as the average SUS calculation [14]. Average of SUS calculations. SUS test results can be shown in graphic and in Fig 5.

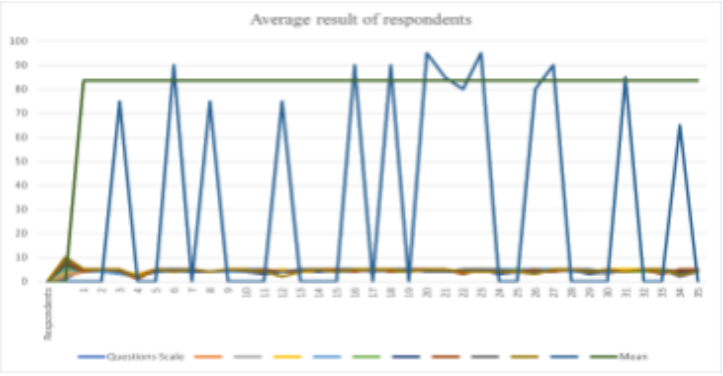

Fig. 5. SUS Test Results

The line chart above shows data from 35 respondents of the test questionnaire. The testers evaluated the application by filling out the test questionnaire provided. In the line diagram, there is a blue line which is the scale of the question and the green line is the average score obtained. As for the rules, odd points minus 1 and number 5 minus even points. Then multiplied by 2.5, get points. In the test results, the SUS average shows the results of application testing conducted by 35 respondents. So, from the results of the above calculations, giving an average SUS value of 84.78, it is concluded that the application can be accepted by users at the Very Good Rating category level can be seen in Fig 6.

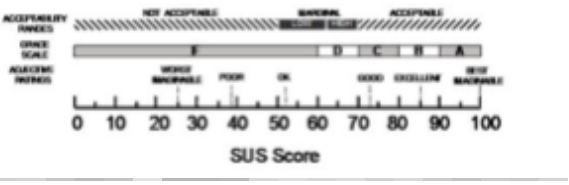

Fig. 6. SUS Score

3.2.4 Testing Documentation

Fig. 7. Testing Documentation

3.2.5 Criticism and Suggestions for Improvement

The appearance of the application is good and easy to understand, the font looks modern and simple. The idea is also cool and interesting to know the flora in Indonesia. It would be better if details are added for the progress of planting our plants and reminders to water the plants. I personally like it and if this is disseminated and many users can have a really good impact on the environment. You can also add interesting fun facts or simple planting tips on the main page, maybe if it grows it can be uploaded based on each community.

4. Conclusion

This research has examined the development and implementation of the AkarJaga application that aims to document and preserve Indonesian flora through digital technology. Tests developed using the black box testing method show that the system is able to display information in accordance with the tested which can be seen in Table 3 Table of Blackbox Testing Stage and the System Usability Scale (SUS) method shows that the score obtained from the test results conducted by 35 correspondents is 84.78 which means this value is at an excellent level which can be seen in Fig 6 SUS Core Categorization. Usability score in the table is an average calculation based on the number of testers on each task. The data transferred into the table is accurate data obtained from the testers' answers to the tested functions. Based on table 2, the results of application testing show varying results. “Sign up or login” had a usability score of 85 indicating user difficulty. Although part of the task is completed, the click error rate is still quite high (39.4%) and the average duration is quite long (16.9s) indicating the interface is quite efficient and for the number of people who do the tester is 33. On “Find Plants” has usability testing 61 indicating user difficulty, then the click error rate is at 36.7% the lift is still quite high with a long average duration (59.5s) indicating users are somewhat confused in finding a plant search engine with the number of testers 25 also the mission is not completed at

24%. The results show that the app provides rich and useful information about flora, as well as interactive features that increase user engagement. With the support of an active community, the app has successfully created a platform that supports the exchange of knowledge and experience. The collection of high-quality multimedia materials is the key to the success of this application. In the future, the app developers are advised to add more interactive features, expand the plant database, and improve the functionality of the community. Collaboration with research institutions is also important to ensure the content remains relevant.

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