

DESIGNING AN ANDROID-BASED DIGITAL MUSEUM APPLICATION AS A VIRTUAL VISIT TO THE MUSEUM

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Abstract

The Sang Nila Utama Museum is one of the most comprehensive museums in Riau Province. Currently, the Sang Nila Utama Museum has more than 4000 collections divided into ten classifications: Geology, Biology, Ethnography, Archeology, Historics, Numismatics, Philology, Ceramics, Arts, and Technology. From founded in 1991 to 2018, visits to Sang Nila Utama Museum can be done offline; however, since the COVID-19 pandemic began to enter Pekanbaru City, Sang Nila Utama Museum has been closed to the public. With the closure of the Sang Nila Museum, the museum's function as an educational tour, cultural and heritage tourism has been inhibited. The digital museum application is a solution to make museum visits no longer limited to offline visits but can also be done virtually. The application exhibits all museum collections, which consist of ten classifications, with a total collection of nearly 300 collections. Based on the test results, the digital museum application got good responses from the users and has met the five aspects of usability testing with an average usability value above four which is above the median value on a scale of five.

1.0 INTRODUCTION

There are six museums in Riau Province spread over several regencies and cities. These museums are the Sultan Syarif Kasim Museum in Bengkalis Regency, the Sang Nila Utama Museum in Pekanbaru City, the Tionghoa Museum in Rokan Hilir Regency, the Museum of Culture and History of Siak Balai Rung Sri in Siak Sri Indrapura Regency, the Palace Museum (Siak) Asserayah El Hasyimiah in Siak Sri Indrapura Regency, and the Kendil Kemilau Emas Museum in Kampar Regency. The Sang Nila Utama Museum is one of the most comprehensive museums in Riau Province. This museum was previously named the Riau Province State Museum, which was founded in 1991 based on the Minister of Education and Culture decree Number 001/0/1991, then changed its name to the Sang Nila Utama Museum and at the same time changed its status to a regional museum in 1999 [1].

The Sang Nila Utama Museum collects Riau Malay cultural heritages, including traditional wedding clothes, games, musical instruments, artifacts, miniature historical buildings, and other collections. Currently, the Sang Nila Utama Museum has more than 4000 collections divided into ten classifications: Geology, Biology, Ethnography, Archeology, Historics, Numismatics, Philology, Ceramics, Fine Arts, and Technology. According to Endrizal, the Coordinator of the

Sang Nila Utama Museum, in 2018, the number of visitors to the museum increased every month. In January 2018, the total number of visits to the museum initially amounted to 2,275 people, which then increased to 4,369 visitors in February 2018. Endrizal also explained that, on average, the most visitors came from children who were in kindergarten and elementary school. In addition to kindergarten and elementary school children, visitors to the Sang Nila Utama Museum also came from several junior high and high school students. College or University students and the general public are also recorded visiting the Sang Nila Utama Museum. Moreover, visitors to the Sang Nila Utama Museum also came from foreign tourists from January to February 2018.

However, visits to the Sang Nila Utama Museum have been canceled since the Covid-19 pandemic entered Indonesia, especially in Pekanbaru City, mainly when the positive Covid-19 continues to increase. In response to this, and with the enactment of PPKM (Enforcement of restrictions on community activities) in Riau province, the Sang Nila Utama Museum has been closed since April 2020. The Culture Service of Riau Province began closing the Sang Nila Utama museum after the Governor of Riau issued the closure of all schools from kindergarten to university. It is to prevent outdoor activities and to reduce crowds to anticipate the spread of the Coronavirus (Covid 19). With the closure of the Sang Nila Utama Museum, the function of the museum as an educational tourism object [2][3][4], cultural and heritage tourism [5] was inhibited and not implemented. The online learning process is not accompanied by complete and efficient learning resources, especially in historical subjects. History subject teachers who usually link history learning with the local historical sources are constrained by the lack of access to museums due to the prohibition during the Covid-19 pandemic. In response to this, it is necessary to involve technology to present the museum by adjusting the situation and conditions during and after Covid-19.

The digital museum application is a solution to make museum visits no longer limited to offline visits but can also be done online, virtually, anytime, and anywhere. The museum application has been built previously for various purposes, including the Android-based Application of Lampung Museum, which was created to introduce museum collections to local and international tourists [6]. There is also a Mobile Museum Guide Application designed to convey all the information about the available museum collections [7]. Virtual museum tour applications have also been built to present the atmosphere of a museum visit [4][8]. Furthermore, Augmented Reality (AR) technology has been utilized to introduce various collections in the museum and enhance the visitor's learning experience [9][10][11][12]. Some applications use Virtual Reality (VR) technology to enable visitors to gain enjoyable and immersive information about Museum collections [13][14][15].

In this study, the Digital Museum Application that was built aims to provide information about all the collections exhibited by the Sang Nila Utama Museum. The application was also built to give the feel of a virtual museum visit. To the best of our knowledge, this application is the first application in Riau Province that provides full information about Museum Collection. Therefore, this application can be used to virtually introduce Riau Culture both to local and international tourism. The collections exhibited by the Sang Nila Utama Museum consist of 10 classifications, with a total collection of nearly 300 collections. Mobile applications are built based on Android, considering the target users are the general public of all ages and circles, and Android is the most widely used mobile operating system in Indonesia [16]. Through this digital museum application, users will be able to see various pictures of museum collections; a description of the collection also accompanies each collection as a "guide" of the museum visit. Based on the tests we did, the users could use the digital museum application well and got good responses.

2.0 RESEARCH METHODOLOGY

This chapter explains the stages of building a digital museum application. Figure 1 describes the stages of designing a digital museum application. In the first stage, the process begins with the data collection in the form of identifying problems at the Sang Nila Utama Museum. Problem identification is supported by interviews with the museum administrators while conducting literature studies related to the museums and designing digital museum applications. The second stage is application design which begins by analyzing application requirements obtained from the previous data collection process. In this stage, use case

diagrams and application interface designs are created. The last step of this stage is application implementation. Furthermore, in the next stage, application testing is conducted, and the conclusions are drawn from the tests that have been carried out.

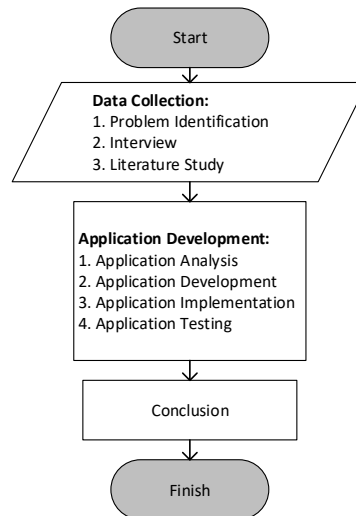


Figure 1. Research Methodology

The Digital Museum application is made using the waterfall methodology, as seen in Figure 2. The waterfall methodology was chosen because the application development can be carried out in stages, and the application requirements are precise, which makes this methodology the best option [17]. It can be seen in Figure 2 that the design of applications using the waterfall methodology has the advantage of sequential and detailed stages, so this method is widely used in system or application development [18][19].

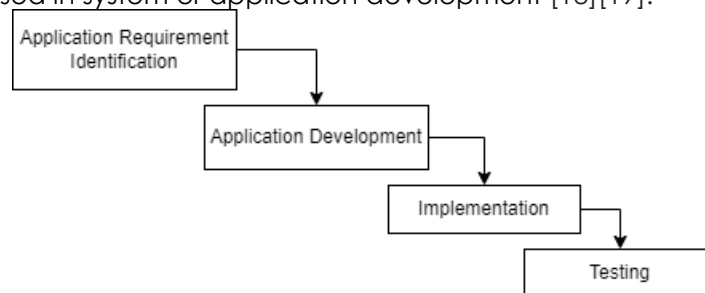


Figure 2. The Stages of Waterfall Methodology

In the Application Requirement Identification Stage, we tried to figure out the requirements through interviewing museum staff to get the business process. After that, we designed the application based on the Application Requirement. In this stage, we designed a use case diagram, flowchart, and application wireframe. We then built the application based on the design and finally conducted a testing to evaluate the application.

3.0 APPLICATION DEVELOPMENT

This chapter describes the application design, which includes the general architecture of the application, use case diagrams, and the application flowchart.

3.1. Application Architecture

The general architecture of the digital museum application can be seen in Figure 3. In As seen in Figure 3 that in making an Android-based digital museum application, there is a web-based admin system that the museum administrator fully manages.

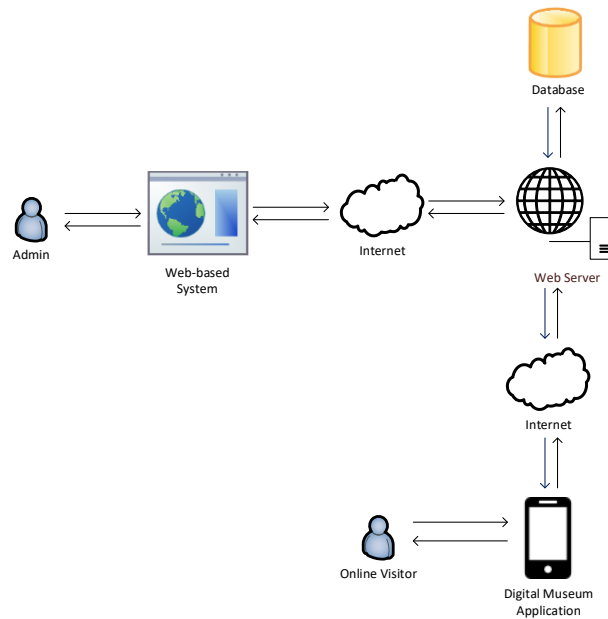


Figure 3. The General Architecture of Application

The web-based system is built for collection management, both exhibited collections and collections in museum warehouses, so all museum collection data is stored in a structured database. Therefore, if the museum collection continues to grow, this web-based system will be very useful in storing and updating digital collection data. A web-based system is also used to update the collections on display, for the collections will be updated once a year. All museum collection data is stored on a web server, then the collections displayed on the Android-based application are only collections with the "Exhibit" category. When online visitors use the mobile application, they must fill out a visit form before starting an online visit. Visitor data will be stored in the museum database as evaluation material for museum management.

3.2. Use Case Diagram

Use case diagrams of the digital museum applications can be seen in Figure 4 as follows:

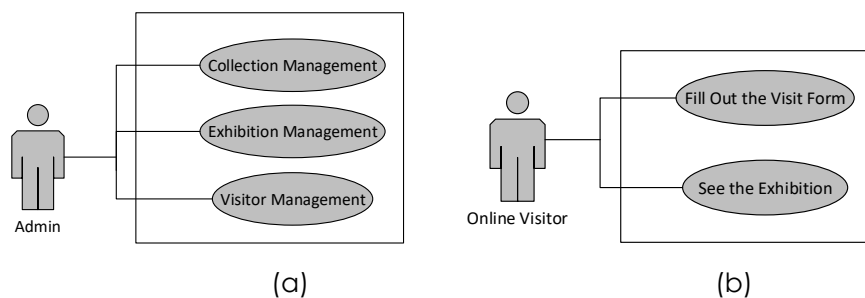


Figure 4: (a) Use Case Diagram of Collection Management System (b) Use Case Diagram of Digital Museum Application

As explained in the previous sub-chapter, in making an Android-based digital museum application, a web-based system is needed to manage exhibited museum collections and eventually will be displayed in an Android-based application. Figure 4 (a) above explains what admins (museum administrators) can do.

As seen in figure 4 (b), the Android-based digital museum application will be used by the general public, from kindergarten students to adults, as online museum visitors. When using the application, online museum visitors are required to fill out a visit form, and then visitors can view the desired collections.

3.3. Application Flowchart

The flowchart below explains the user's process when using the application. It can be seen in Figure 5 that when the online visitor opens the application, the online visitor will be presented with a visit form that must be filled with data and the purpose of the visit. After the visit form is submitted, the online visitor will be presented with a collection of classification views; here, the online visitor can choose which classification they want to see first. If the online visitor selects a classification, a collection view of that classification will appear, and the online visitor can also view the collection details. If the online visitor wants to view the collection set of another classification, the online visitor can return to the main menu containing the classification set.

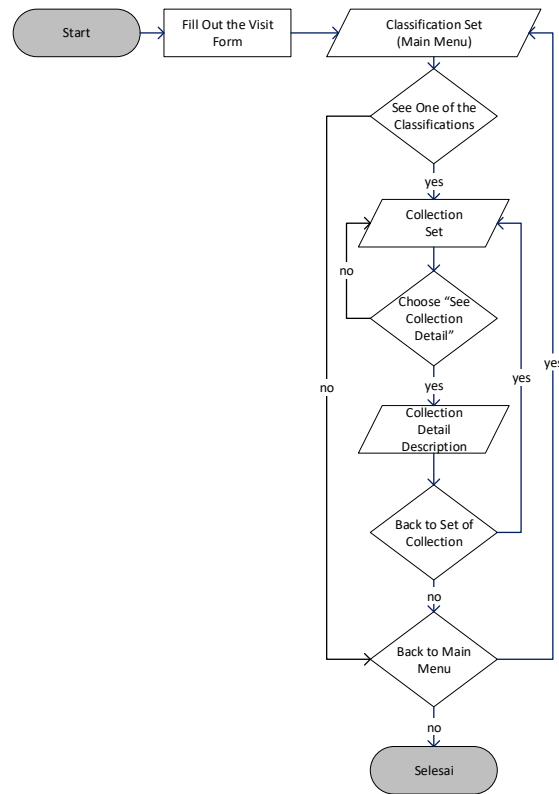


Figure 5. The Application Flowchart

4.0 RESULT AND ANALYSIS

This chapter describes the application implementation, application testing and the test results.

4.1. The Interface of Collection Management System

Figure 6 below is the interface of the museum's collection management system, which is also needed to display the collections displayed in the Android-based application.

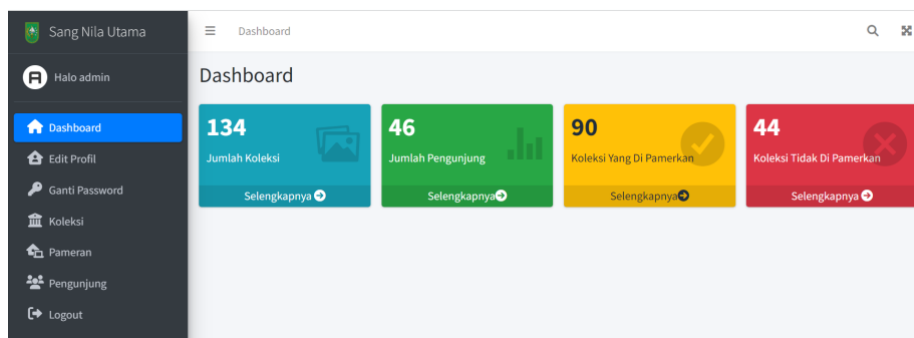


Figure 6. The Collection management system's Dashboard

As seen in Figure 7, the "Collection" menu is to manage the museum collection, the "Exhibition" menu for exhibition management, and the "Visitors" menu for museum visit management. Exhibition Management is to determine whether a collection will be displayed on the android-based application or not.

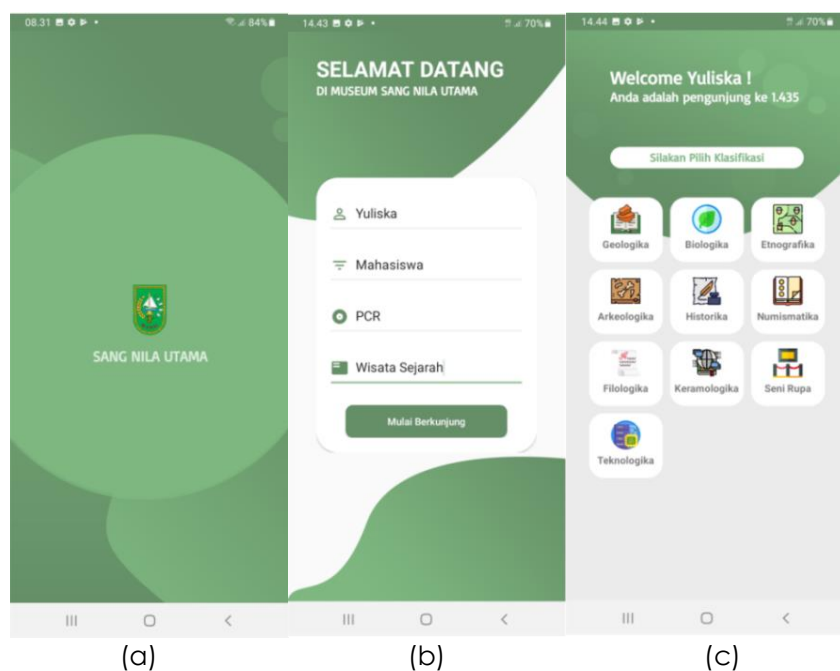
No Regis	Klasifikasi	Nama Koleksi	Deskripsi	Gambar	Aksi
10.01/2017	Teknologika	Radio	Bahan: Kayu, kain, plastik dan porselin Bentuk: Persegi panjang...		Pameran
10.02/2017	Teknologika	Gramofon	Bahan: Kayu dan besi Bentuk: Badannya ...		Pameran
10.03/2017	Teknologika	Setrika	Bahan: Kayu dan besi Bentuk: Bilet oval, marak butterfly, mem...		Pameran

Figure 7. Collection Management to Manage Collection Displayed in Android-based Application

4.2. The Interface of Android-based Digital Museum Application

Figure 8 shows the interface of the android-based digital museum application and explains the path that will be followed by online visitors of the Sang Nila Utama Museum. When opening the application, visitors will be presented with a visit form, as shown in Figure 8 section (b).

After completing the visit form, the ten classifications of the Sang Nila Utama museum will be displayed. The online visitors can choose one of the classifications to display their collections, as seen in Figure 8 section (c). The display of the collections according to the classification can be seen in Figure 8 section (d), Figure 8 section (e), and section Figure (e). Visitors can click the "View" button to view the details of the collection as shown in figure 10 parts (g), figure 8 parts (h), and figure 8 parts (i).



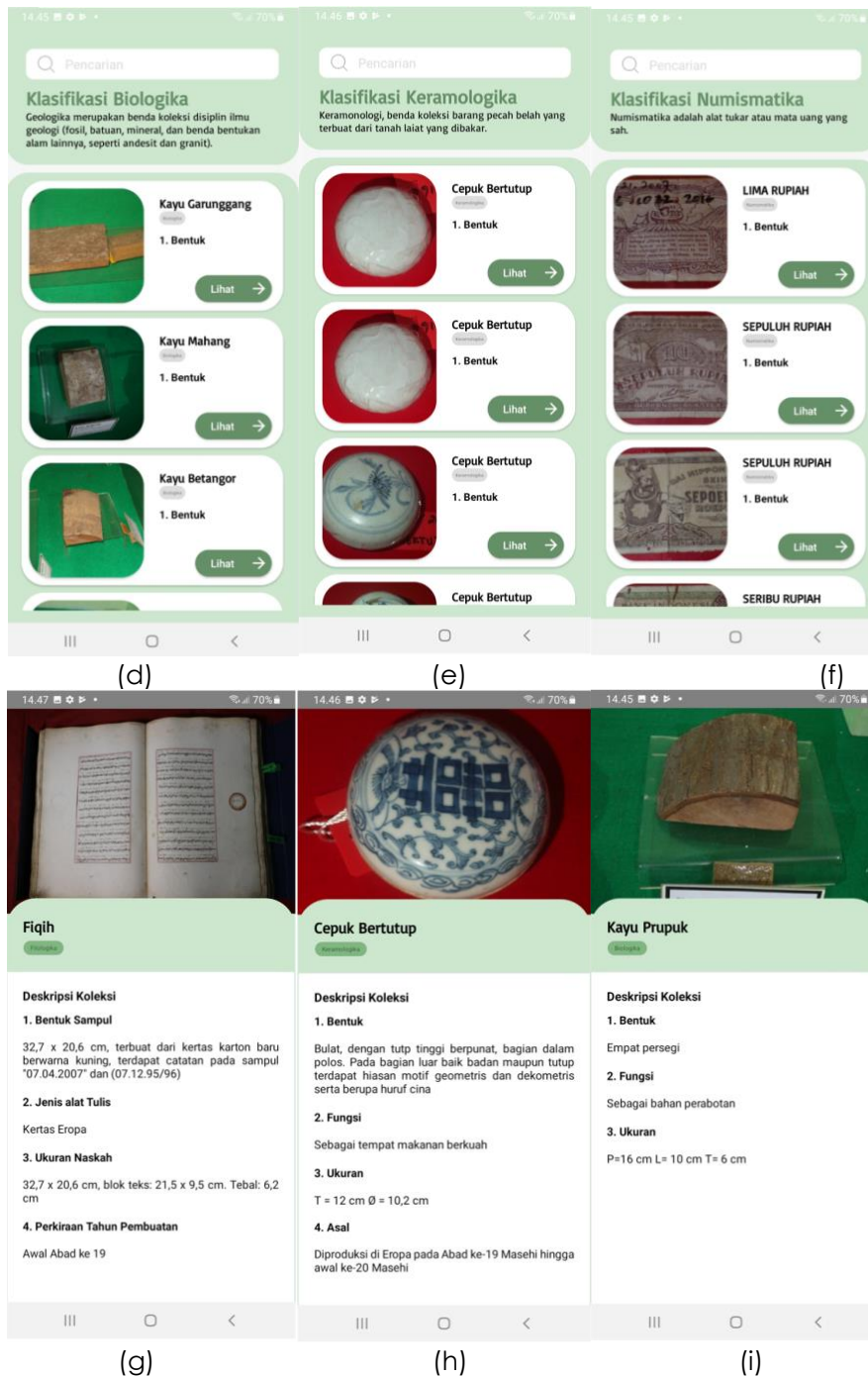


Figure 8. The Interface of Digital Museum Application: (a) Splash Screen (b) Visit Form (c) Classification options visitors want to see (d) Biological Classification Collections (e) Ceramics Classification Collections (f) Numismatics Classification Collections (g) The Description of one of the philological collections (h) The description of one of the ceramics collections (i) The description of one of the biological collections

4.3. Result and Analysis

4.3.1. Usability Testing

Testing is carried out only on the android-based application because this application is the focus of the discussion. Usability testing is commonly used to test the effectiveness and user satisfaction of an application or system [20][21]. The test will be carried out using usability testing with the tasks described in table 1. This test is conducted to test the quality of the application in terms of the ease with which the user can learn the application functions (Learnability (LR)), application efficiency (Efficiency (EF)), the user's ability to remember the application's functions

that have been used (Memorability (MR)), error (ER), and user's satisfaction with the application (Satisfaction (SF)).

Table 1. Usability Testing Tasks

No	Task
1	Open Digital Museum Application
2	Fill out and submit the visit form
3	See the main page containing the set of museum class
4	Choose one of the classifications
5	See the set of collection of a classification
6	Push "see collection detail" button
7	See the detail information of a collection
8	Search a collection

The task in table 1 will be given to 30 respondents consisting of the general public and students. Testing data collection will be carried out using a questionnaire. Then, the Likert Scale is also utilized to score the given task.

Table 2. Likert Scale

QQ	VD	DA	QA	A	VA
Value	1	2	3	4	5

Explanation:

- QQ = Questionnaire Question
- VD = Very Disagree
- DA = Do not Agree
- QA = Quite Agree
- A = Agree
- VA = Very Agree

The following table 3 describes the questionnaire questions and the plots of the five aspects of usability testing.

Table 3. Usability Aspects Plot

No	Questions	Usability Aspects				
		LR	EF	MR	ER	SF
APPLICATION ASPECT						
1	Is the interface of the digital museum application easy to recognize?					
2	Is the Digital Museum Application Easy to use?					
3	Is the color used on the digital museum application comfortable to see and not boring?					
USER ASPECT						
4	Is the menu in the digital museum application easy to recognize?					
5	Is the collection information on the digital					

	museum application easy to find?		
6	Is the text easy to read?		
7	Is the application easy to download?		
8	Are the digital museum application's symbols, icons, and images easy to understand?		
INTERACTION ASPECT			
9	Is it easy to access the information offered?		
10	Are the functions offered following the purpose of the digital museum application?		
11	Are the menus and the interface of the digital museum application easy to remember?		

4.3.2. Result Analysis

The results of the questionnaire questioned to 30 respondents are as follows:

Table 4. Testing Result

No	Questions	Value
APPLICATION ASPECT		
1	Is the interface of the digital museum application easy to recognize?	3.93
2	Is the Digital Museum Application Easy to use?	4.16
3	Is the color used on the digital museum application comfortable to see and not boring?	4.06
USER ASPECT		
4	Is the menu in the digital museum application easy to recognize?	4.1
5	Is the collection information on the digital museum application easy to find?	4.1
6	Is the text easy to read?	4.3
7	Is the application easy to download?	4.4
8	Are the digital museum application's symbols, icons, and images easy to understand?	4.2
INTERACTION ASPECT		
9	Is it easy to access the information offered?	4.06
10	Are the functions offered following the purpose of the digital museum application?	4.23
11	Are the menus and the interface of the digital museum application easy to remember?	4.13
Average		4.15

Table 4 above shows that the ten average scores of 11 questions are above 4, with 1 question point having a value of 3.93, with an average score of 4.15. Therefore, it can be concluded that the digital museum application has met the usability points (having a good usability score), namely Learnability, Efficiency, Memorability, Error, and Satisfaction. The following is a detailed explanation of the five points:

- a. Learnability: Question number 8 has an average score of 4.2. It shows that the digital museum application has a good learnability value.
- b. Efficiency: Questions 5 and 9 have average scores of 4.1 and 4.06. It shows that the digital museum application has a good efficiency value.
- c. Memorability: Question number 11 has an average score of 4.13. It shows that the digital museum application has a good Memorability value.
- d. Error: Questions 6 and 7 have an average score of 4.3 and 4.4. It shows that the digital museum application has a good error handling value.
- e. Satisfaction: The average score of all questions is 4.15. It shows that the digital museum application has a good Satisfaction value.

5.0 CONCLUSION

The digital museum application is a solution that we offer to make museum visits no longer limited to offline visits but can also be done online. The Digital Museum application includes all collections exhibited by the museum, with a total collection of nearly 300. The testing is conducted by distributing questionnaires to 30 respondents, ranging from students and teachers to freelancers. Based on the test results, the digital museum application got good user responses and has a good usability value. The application has met the five aspects of usability testing, namely Learnability, Efficiency, Memorability, Error, and Satisfaction, which have an average score above four which is above the median value on a scale of five.

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