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MOBILE GUIDING APPLICATION FOR TOURISTS IN A GEOPARK AREA IN INDONESIA

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Abstract

Mobile Guiding is a new technology to be applied to cellular-based tourism which can provide information and education for tourists who visit tourist destinations. This study focuses on the application of the design science research approach in terms of developing a mobile guiding application (M-Geopark) in the Ciletuh - Palabuhanratu Geopark area, Indonesia. A practical challenge that motivates the development of the M-Geopark application is the establishment of the new Global UNESCO Geopark Ciletuh-Palabuhanratu as a new tourist destination with many and extensive tourist routes and attractions. There are more than 28 tourist attractions spread across 8 districts and 74 villages in the Ciletuh and Palabuhanratu areas with an area of 1,280 km2. The M-Geopark application facilitates tourists in fulfilling information and education about tourism on mobile devices supported by video views up to 360 degrees and the integration of four software: programming tools (Android SDK, unified modelling, MySQL), graphics tools, sounds tools, documents, and present tools. The first part of this paper describes the analysis, design, and implementation of activities related to M-Geopark development. Then, it also discusses the characteristics and scope of M-Geopark's compliance with the nature and ideas of design science research. To evaluate the M-Geopark, an experiment was conducted with 57 tourists from the Ciletuh-Palabuhanratu Geopark. This study evaluates the feasibility, effectiveness, and ability of M-Geopark in tourism by conducting a Usability Testing on the M-Geopark application. The purpose of this Usability Testing is to assess the ability of the M-Geopark application. One of the Usability measurement tools is the USE Questionnaire, which is divided into three main parameters, namely usefulness, satisfaction, and ease of use. The results showed that the M-Geopark application was informative, user friendly, educational and had a minimum capacity. M-Geopark was created as a solution and a form of need to answer information and education problems for tourists who will travel to the UNESCO Global Geopark Ciletuh-Palabuhanratu.

Keywords: Design science research, M-Geopark, Mobile guiding, Tourism, Tourist.

1. Introduction

Traveling for most people is a trip to find new experiences with the aim of having fun or refreshing. However, it is not easy for tourists to get complete, accurate and up-to-date information about the destination of the tourist attraction to be visited. Things that need to be considered while in the tourist destination area are seeing the correctness of information about accommodation, facilities, and infrastructure at the tourist destination. Therefore, in taking a tour, the need for information, accommodation and transportation is very important because it affects tourist satisfaction during the tour [1-3]. This is in line with the establishment of the new global UNESCO Geopark Ciletuh-Palabuhanratu area as a new tourist destination, so there is a need for proper planning regarding information, accommodation, and infrastructure at tourist destinations. This new Geopark area is undergoing establishment development stages from various aspects, especially from the aspect of information and education related to existing places [4, 5]. Tourists who come are often faced with the problem of various routes and tourist attractions available. There are more than 28 tourist attractions spread across 8 districts and 74 villages in the Ciletuh and Palabuhanratu areas with an area of 1,280 km^2. In addition, tourists who come are faced with the problem of limited local guide knowledge due to the low level of education. Based on existing problems, the main functional requirement for mobile applications is the ability to support application involvement as a helpful guide to tourists at any time to provide complete information.

Mobile application is an application that allows users to perform mobility using equipment such as mobile phones or smartphones. By using a mobile application, users can easily carry out various kinds of activities ranging from finding information about accommodation, facilities, and infrastructure at tourist destinations [6, 7]. Mobile applications are also known as applications that can be downloaded and have certain functions, thereby adding to the functionality of the mobile device itself [8, 9]. One of the operating systems that is currently developing quite rapidly is Android. This can be seen from the support of several major vendors, such as Samsung, HTC, Motorola, G, Huawei, Sony Ericson, Acer, Asus, T-Mobile, and many other vendors who use this operating system in the various gadgets they produce. Android is an open-source operating system so it is free to be distributed and used by any vendor. Along with the development of Android technology and the importance of information on tourism objects and tourism supporting objects in the Ciletuh-Palabuhanratu geopark, an application is needed that makes it easy to get information about the location of tourism objects and tourism supporting objects in the geopark area by using a smartphone with the Android platform as the medium. By utilizing the Geopark Ciletuh - Palabuhanratu tourism mobile application, it is hoped that visitors to tourism objects, especially users of mobile devices with the Android operating system, will find it easy to obtain tourism information.

This study applies the framework (DSR-Deign Science Research) proposed by Johannesson and Perjons [10] to develop new cellular information and education, called the M-Geopark. The purpose of this research is to describe the design and implementation of M-Geopark mobile application activities based on DSR principles, which can help tourists get information and education in the Ciletuh-Palabuhanratu Geopark area. By not ruling out the M-Geopark evaluation process, this research will answer the following problem formulations: How to test the M-Geopark application using the Usability USE Questionnaire for tourists visiting the

UNESCO Global Geopark Ciletuh-Palabuhanratu. To answer the formulation of the research problem, we conducted a Usability Testing test on the M-Geopark application. Participants in this test were tourists who came to the UNESCO Global Geopark Ciletuh-Palabuhanratu. M-Geopark is used as a technological intervention to manage information and education provided to tourists.

2. Literature Review

Along with the development of increasingly advanced technology, this is a great opportunity for information technology developers, especially now that mobile technology is developing very significantly [11-13]. Since the emergence of mobile guiding in the world, several researchers have attempted to define the term. The initial definition of mobile guiding is the use of mobile phones in a portable and computational manner to support tourism activities [14-16]. Based on the development of mobile guiding, various definitions have emerged regarding mobile guiding which is the application of portable mobile computing devices, such as cell phones, tablets, smartphones, and e-readers, to access information sources, tourist destinations and tourism-related locations [17, 18]. Information is the main requirement for most people by using mobile devices because information can be obtained anywhere in a short time, one of which is Tourism Information [19-21]. The mobile phone-based application is used as a client side in the process of displaying information on tourism objects, the location of tourist objects, the paths that are traversed to get to tourist attractions, and the closest public facilities to the location where we are.

The increase in tourist visits has an impact on the provision of information on tourist destinations and everything related to travel. Nowadays, tourism information is only available on the government website through the provincial tourism offices [22, 23]. This information is still inadequate, especially with regards to tourist destinations and accommodation/tourism travel infrastructure. Lack of this information will result in a decrease in the interest of tourists to visit tourist areas [24-26]. For this reason, it is necessary to build a tool as a means of providing tourism information in the form of a tour guide. Tourist areas must have a tour guide to make it easier for tourists [27-29]. The development of an application based on a mobile platform is similar to building a software on an embedded application, where more factors need to be considered compared to traditional software development. This guiding mobile application is a medium for introducing tourist objects, culture and history which are presented in the form of an android application to make it easier for users to convey information interactively [30-32]. Therefore, in order for the provision of travel information to be effective, the use of mobile applications via smartphones can be used [33, 34].

Currently, the use of mobile devices on smartphones is increasing because most people, including tourists, have become accustomed to using them in their daily lives. There are several reasons for using mobile guiding as a solution for providing travel information, including: (1) Internet users via mobile devices in Indonesia, both national and international tourists, reached 83.44%, (2) Searching for information via mobile devices reached 87.13%, (3) Increasing internet users, especially through mobile devices reaching 37.12% per year, and (4) Daily internet access via mobile devices reaching 65.98% [35, 36]. The highest age for internet users via mobile devices is 25 to 34 years, and at that age travel trips are often

carried out. The evaluation of the guiding mobile application in tourism really needs to be done to test the level of satisfaction, usefulness, and usability which are important factors in the development of the mobile guiding application.

3. Research Framework Design and Methods

3.1. Design science research (DSR)

Design Science Research (DSR) is a systematic study that develops solutions related to practical problems that arise and develop in society. This DSR does not start from theory but appears in line with existing problems. In its research strategy, DSR starts from how to design applications to identify basic problems, describe applications, define objectives for solutions, design, develop, and demonstrate applications, and evaluate the application [10]. The DSR framework in this study is used to develop the Mobile Guiding application in the UNESCO Geopark Ciletuh-Palabuhanratu area. This DSR has five stages, including explicate problems, namely activities where the researcher can explain the existing problem; outline artifact and define requirements, namely the process by which the researcher describes the application and determines the requirements to answer the problem; design and develop artifact, namely the process of designing and developing applications; model artifact namely the process of demonstrating the application that has been created; evaluate artifact is the final process to evaluate an existing application whether it has become a solution related to a problem. Next, we use the acronym EODDE to refer to the framework. Design science research framework can be seen in Fig. 1.

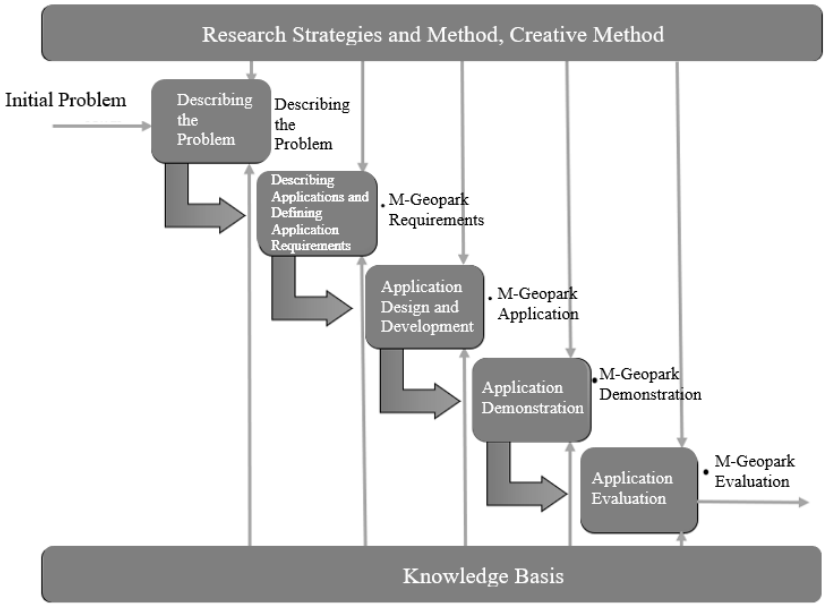

Fig. 1. Design science research framework [10].

There are several steps that must be taken in using EODDE. First, the researchers must be able to explain the existing problem, which means to explain the problem and show that the problem is important to solve behind the DSR

process [10]. This first phase aims to explain the initial problem, position the problem appropriately, form the appropriate problem, and find out the importance of this problem being researched. The existing problems should be interesting and become problems in general in society. The problem must also be analysed and can be defined. The second step in the EODDE system is to describe the application and define the application requirements. The purpose of this second activity is to define the needs and expectations of using applications in providing solutions to problems [10]. The third step is that the researcher must be able to design and make an application. At this stage, the researcher describes how the application made must be in accordance with the function to answer problems that exist in society. The fourth step is that the researcher must be able to show the application display which present the available menus and application functions in answering and solving problems in society. The fifth step is evaluation of the application which aims to find out and evaluate whether the performance of the application in its use has answered existing problems. Evaluation aims to measure a process whether an activity or program that has been implemented is in accordance with the previous planning or objectives.

4. Design and Development of M-Geopark Application

4.1. Explanation of problems behind M-Geopark

A practical challenge that motivates the development of the M-Geopark application is the establishment of the new global UNESCO Geopark Ciletuh-Palabuhanratu area as a new tourist destination. This new Geopark area is undergoing development stages from various aspects, especially from the aspect of information and education related to existing places. Often tourists who come are faced with the problem of various routes and tourist attractions available. There are more than 28 tourist attractions spread across 8 districts and 74 villages in the Ciletuh and Palabuhanratu areas with an area of 1,280 km2. In addition, tourists who come are faced with the problem of limited local guide knowledge due to the low level of education. Based on existing problems, the main functional requirement for the M-Geopark application is the ability to support the involvement of M-Geopark as a guide to tourists at any time.

4.2. Explanation of solutions and forms of needs

M-Geopark is created as a solution and a form of need to answer the problems of tourists who will visit the UNESCO Global Geopark Ciletuh-Palabuhanratu. In addition, M-Geopark can be used by the general public as a learning medium related to the information of UNESCO Global Geopark Ciletuh-Palabuhanratu. One of the ways to support and answer tourist problems through M-Geopark is by using mobile communication functions, such as chat and email available at M-Geopark. Another requirement fulfilled by M-Geopark is utilizing the ability of mobile devices as technology to support tourist activities anywhere and anytime. For example, M-Geopark supports the availability of complete information related to the UNESCO Global Geopark Ciletuh-Palabuhanratu which is supported by 360 videos, 3D games and the use of device features, such as cellular data, Bluetooth, Wi-Fi, and GPS. These things are consistent with the reality that mobility, social networks, and context awareness are important functions of the 21st century.

4.3. Development design of M-Geopark application

M-Geopark is a mobile guiding application that contains tourism information, especially about the UNESCO Global Geopark Ciletuh-Palabuhanratu. The physical structure of M-Geopark consists of the M-Geopark information center administration, user, database, and server. The administration of the M-Geopark guiding information center is at the heart of the entire running of the system. In the M-Geopark application there are eight menus/tabs/windows consisting of the UNESCO Global Geopark Ciletuh-Palabuhanratu Area Menu, Tourist Destinations, Diversity, Biodiversity, Travel Routes, and Earthquake Hazard Zone.

4.4. Implementation of M-Geopark system

The use of programming language, software, and tools that we use to implement these applications are as follows:

4.4.1. Hardware

The hardware components used to implement the M-Geopark system can be seen in Table 1.

Table 1. Hardware.

Tools	Specification
Laptop Asus X550V	15,6 Inch, Windows 10, Intel (R) core (TM) i7-7799HQ CPU @ 2,80 GHz 2,81 GHz, 1TB Hard Drive, 8GB of DDr SDRAM.
Personal Computer	Microsoft windows 10 (OS), 2.20 GHz Intel Duo Processor, 500GB hard drive, 4GB of RAM
Handphone Oppo A5	Android 9.0 pie, 6,5-inch (720x1600) Screen, Memory 3GB
Samsung Galaxy Tablet	Android 9.0 pie, 8-inch (1280x800) Screen, Memory 3GB
Camera insta 360 oner	

4.4.2. Software

a) Programming tools

- Android SDK, which is an operating system for Linux-based mobile devices that includes an operating system, middleware, and applications.
- Unified Modelling Language (UML), which is a standard modelling language for software development and object-oriented systems. UML provides a visual modelling language that is useful for developers in creating blueprints of the program to be created.
- MySQL, an RDBMS (Relational Database Management System) product which is very popular in the Linux environment but is also available on Windows.

b) Graphics tools

- Blender, which is a tool used for modelling, rendering, and 3D animation. Blender can also be used in video editing, video effects, image retouching, and game development.
- PTGui, an affordable commercial blending tool for creating panoramic images of large landscapes captured by a 360-degree camera. PTGui is a panoramic

stitching software for Windows and Mac OSX. This software was developed as a graphical user interface for Panorama Tools.

- Adobe Illustrator, the leading vector graphics editor program developed and marketed by Adobe Systems. Illustrator CC is the latest version of this program and is the twentieth generation of Illustrator products.
- Adobe Premiere Pro, which is a non-linear based video editing program from Adobe Systems.
- Insta 360, which is a software used to process 360-degree images from the insta 360 camera.

c) Sound tools

- Audacity

d) Document and present tools

- Microsoft Office 2013

The first working version of M-Geopark is a mobile application based on Android. As explained in the design stage, the entire system consists of the client (Android supported mobile device), M-Geopark learning center administration, user, database, and server. To ensure portability, efficiency, and system maintenance, we build each subsystem using different software technologies. The subsystem is connected using dynamic link libraries. After developing the application, we ran it separately on the emulator and the actual device to confirm the functionality of the different units. Then, we install the application on a real mobile device for debugging. Testing was carried out on Oppo A5 7.1 inches and Samsung Galaxy Tablet 8 inches. Implemented applications go through strict tuning and iteration, as defined by the DSR. The DSR framework for M-Geopark is illustrated in Fig. 2. The M-Geopark application is available and can be downloaded for free on the Google Play Store.

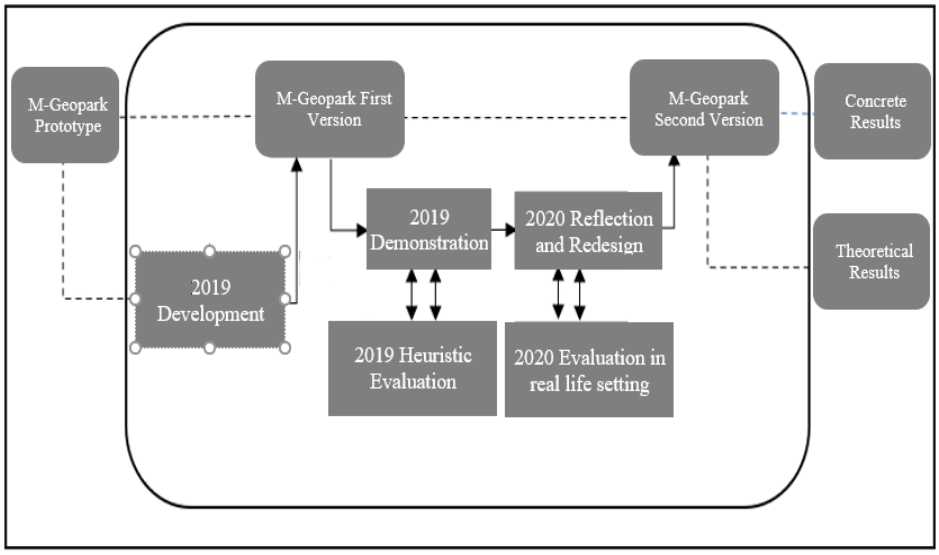

Fig. 2. Summary of the VirTEd DSR process.

5. Demonstration of M-Geopark application

The M-Geopark application on a mobile phone desktop with an Android system is made as a mobile guide for tourists who will visit Geopark Ciletuh. There are various services that can be selected by application users. Figure 3 shows the appearance of the application on the desktop mobile phone with the Android system. Figure 4 shows the main menu that displays all the usable services. Figure 5 shows a guide on how to use the application. Figure 6 shows the GPS menu to find out the user's location. Figure 7 shows the search menu for a location or tourist spot. Figure 8 displays an information menu to explain and show the object being sought. Figure 9 displays the zoom in, home, and zoom out menu to see the display so that it can be tailored to the wishes and needs of the user. Figure 10 is an implementation of the exit menu interface. This application is useful for tourists who come from various places to show routes and tourist objects in the UNESCO Global Geopark Ciletuh-Palabuhanratu.

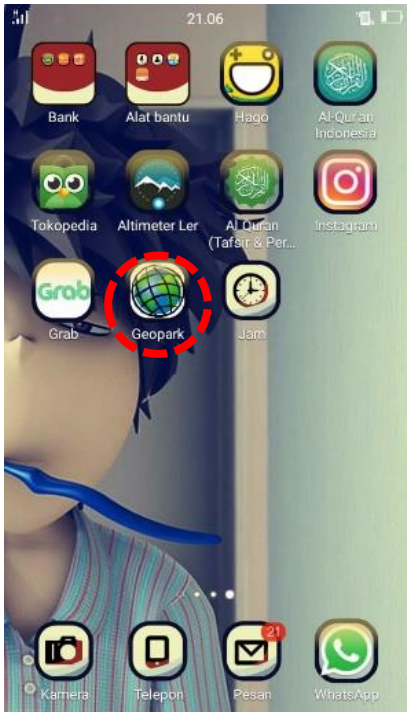

Fig. 3. M-Geopark application.

Fig. 4. Main menu.

Fig. 5. Usage module.

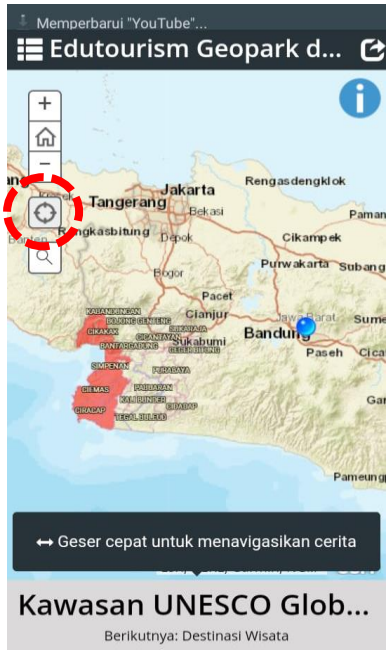

Fig. 6. Choosing current location (GPS) button.

Fig. 7. Presenting location search.

Fig. 8. Description of related object.

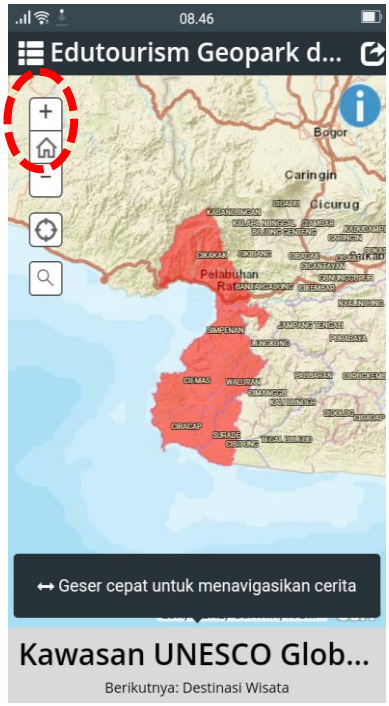

Fig. 9. Displaying zoom-in, zoom-out, and home menu.

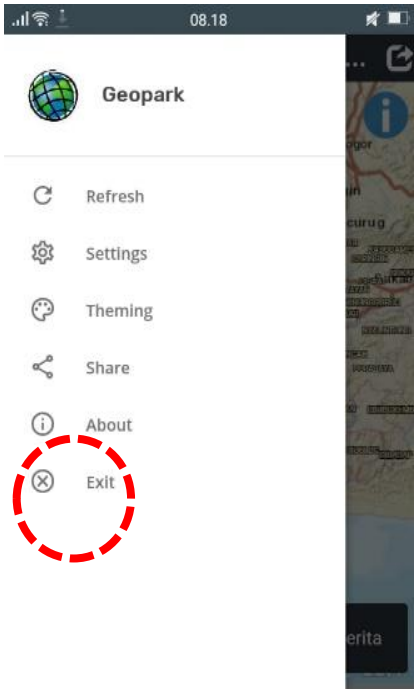

Fig. 10. Implementation of logout menu interface.

6. Testing Evaluation by using M-Geopark Usability Testing

One of the Usability measurement tools is the USE Questionnaire which divides into 3 main parameters, namely usefulness, satisfaction, and ease of use. Each parameter is described into a set of statement packages which are presented to the users in the form of a questionnaire using a Likert scale. Usefulness is the extent to which a product enables users to achieve their goals. These meters are also an assessment of the user's willingness to use the application. Satisfaction is how the user feels when using the product or response to the overall product design. Ease of use is the extent to which the user can operate the system.

Testing the M-Geopark application is carried out in one step only to students by testing the Task Usability Testing of the application. After being given the task, the questionnaire is given to users who have done the tasks that are distributed in order to gain user experience with the appearance of the application being tested, namely what the user sees and feels when performing the given task.

The questionnaire consists of 10 questions for 57 tourists representing the three aspects of the questionnaire, namely Usefulness, Satisfaction, and Ease of use. Each question in the questionnaire aims to show the level of usability according to user acceptance which will be assessed on a scale of 5. Task usability testing of application can be seen in Table 2.

Table 2. Task usability testing of application.

No.	Task	Task explanation
1	Open the M-Geopark application	user tries the application and pays attention to the application interface
2	Open the main menu application	user tries to open the main menu
3	Module usage	user tries to use module features
4	Selecting the button, the current location	user selects the current GPS button
5	Display the location searching	user tries to find tourist locations
6	Displays descriptions related to objects	user tries the virtual tours and does some interactions such as seeing tourist attractions and Video 360
7	Displays magnifying and reducing the research object	user tries the application to zoom in on tourist locations
8	Open Log Out	user opens logout to close the application

7. Research Context and Participants

The research was conducted in the UNESCO Geopark Ciletuh-Palabuhanratu area with the aim of assessing the application used. Participants consisted of 100 tourists who were used as application users, 57 of whom were willing to provide an assessment of the M-Geopark application. Participants drawn based on the demographic results consisted of 35% women and 65% men.

8. Research Instruments

The questionnaire was given to users who had done the above tasks in order to gain user experience with the appearance of the application being tested in relation to what the user saw and felt when working on a given task. The questionnaire contains 10 questions for tourists representing the three aspects of the USE questionnaire, consisting of five items of questions related to Usefulness, four items of questions related to Satisfaction, and seven items of questions related to Ease of Use. Each parameter is described into a set of statement packages which are presented to the users in the form of a questionnaire on a Likert scale. Each question in the questionnaire aims to show the level of usability according to user acceptance which will be assessed on a scale of 5. The value scale and usability aspect of USE questionnaire application can be seen in Tables 3 and 4.

Table 3. Value scale.

PK	STM	TM	CM	M	SM
Value	100	200	300	400	500

Note:-
PK = *Pertanyaan Kuesioner* (Questionnaire Question)
STM = *Sangat Tidak Mudah* (Very Not Easy)
TM = *Tidak Mudah* (Not Easy)
CM = *Cukup Mudah* (Quite Easy)
M = *Mudah* (Easy)
SM = *Sangat Mudah* (Very Easy)

Table 4. Usability aspect of USE questionnaire application.

No.	Question	Factor
1	Are the 360-degree photos and information easy to understand?	Usefulness
2	Is it easy to access the menu offered?	
3	Is the 3D map building easy to use?	
4	Are 360-degree photos easy to use?	
5	Is the application easy to use?	Ease of use
6	Are the colours in the M-Guiding application suitable?	
7	Is the written information easy to read?	
8	Are symbols, icons, and images easy to understand?	
9	Can the application make it easier for users to get information on the tourist location they are looking for?	Satisfaction
10	Does this application make it easier to find tourist locations that you are looking for?	

9. Data Analysis

A combination of quantitative and qualitative approaches was used in data analysis. The collected data is then calculated using a Likert scale based on the answers of the respondents.

10. Results

Based on the results obtained through the Usability USE Questionnaire test using three main parameters, namely Usefulness, Satisfaction and Ease of Use on 57 tourists to the M-Geopark application, several results were obtained. Usefulness as the first parameter measures the extent to which the application allows users to achieve their goals and it is hoped that tourists can judge the usability of the application after using it. The average value of the assessment of the usefulness parameters of 57 respondents is 267.5 with a percentage of 93.8% which indicates that this application makes it very easy for users to help them reach their destination in traveling related to information features in the M-Geopark application (see Fig. 11). The main concern of the respondents is related to the use and purpose of the M-Geopark application, namely photos and videos based on a 360-degree camera containing information, material, tourist locations which, according to the respondents, provide very important information regarding the respondent's purpose of traveling. In addition, there are research findings that respondents are very interested in viewing 360 camera-based photos and videos which have not been widely used in mobile guiding applications in other tourist attractions. The guide features in this application are also very useful and make it easier for application users to determine what places to visit first, given that there are photos and videos related to tourist attractions in the UNESCO Geopark Ciletuh-Palabuhanratu in the M-Geopark application.

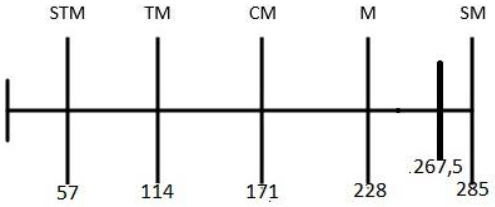

Fig. 11. Average score of usefulness.

Ease of Use as the second parameter measures the extent to which the user can operate the M-Geopark application system. The average value of the Ease-of-use parameter assessment of 57 respondents was 269.7 with a percentage of 94.6% which indicates that this application is easy to operate by users (see Fig. 12). Based on the results of the questionnaire, four question items related to the ease-of-use parameter in using the M-Geopark application show that the application and interface design is easy to use. The colour display in the application is considered suitable for application, and the written information is easy to read. In addition, symbols, icons, and images are also easy to read and understand.

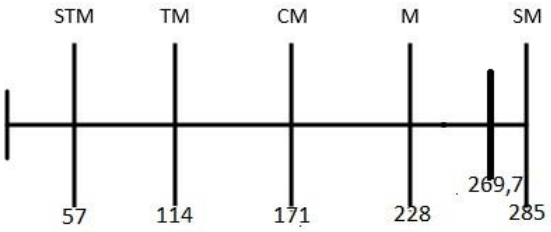

Fig. 12. Average score of Ease of Use.

Satisfaction as the third parameter measures how user satisfaction is when using the M-geopark application. The assessment carried out on this application is carried out in its entirety regarding the application that has been used to help tourists who come to the UNESCO Geopark Ciletuh-Palabuhanratu. The average value of the satisfaction parameter assessment by 57 respondents was 276 with a percentage of 96.8%, which indicates that this application makes it very easy for users to experience using the application (see Fig. 13). Based on the results of the questionnaire, two question items related to the Satisfaction parameter in the use of the M-Geopark application show that this application makes it very easy for users to find out more about tourist sites to visit, especially because they are displayed attractively through the 360-degree camera-based video view feature. Users also get an overview and information regarding tourist places starting from the distance to the desired location, an overview of the place to be headed, and educational information on the place of destination.

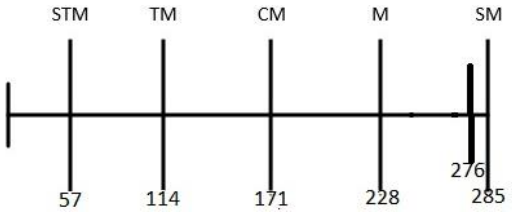

Fig. 13. Average score of satisfaction.

11. Discussion

The purpose of this study is to evaluate the M-Geopark application, a tourist application with the context of providing information and education related to the Ciletuh - Palabuhanratu Geopark area. Our attention is focused as a solution and a need to answer the problems of tourists who will visit the UNESCO Global

Geopark Ciletuh-Palabuhanratu. Besides, M-geopark can be used by the general public as a learning medium related to UNESCO global information on The Ciletuh-Palabuhanratu Geopark. One way to support and answer tourist problems through M-Geopark is by facilitating tourists in fulfilling information and education about Ciletuh - Palabuhanratu Geopark Tourism on mobile devices supported by information that can be accessed anywhere, even providing interactive views of tourist attractions with 360-degree video displays.

The results of this study indicate that the M-Geopark application is considered easy to use by users, namely the tourists. Based on the results of Usability Testing using the USE Questionnaire measurement device, three main parameters, namely Usefulness, Satisfaction and Ease of Use, are important factors in developing mobile learning applications.

The results we get from testing the application by users on the Usefulness aspect show that the M-Geopark application is considered very easy to use. Satisfaction aspects are considered very easy and very helpful for users in solving solutions related to tourism learning. Judging from the ease-of-use aspect, this application is considered easy to operate by the user. This is in accordance with the statements of several researchers regarding how to evaluate guiding mobile application testing using Usability Testing [37-39]. Evaluation of mobile application testing using Usability Testing serves to see the utility of application functions, effectiveness, and efficiency of the applications for users. The similarity of the evaluation results of the M-Geopark application with the results of the assessment of other applications is in the aspect of Ease of Use of the application. Meanwhile, what distinguishes it from other applications is the function and usefulness of the application seen from the content.

The application we designed has a different focus, where the material we display regarding information and education of the Ciletuh-Palabuhantatu Geopark is different from previous application research, for example in [40-42] which mostly focuses more on general application usage. The results of other studies also show that the use of mobile guiding applications can provide information and education for tourists [43-45]. Although many similar studies have been conducted, our findings support the expansion of novelty about mobile guiding devices, particularly in the field of tourism education and information. In addition, the flexibility of using mobile devices allows tourists to use the application anytime and anywhere [46, 47].

The M-Geopark application provides a travel experience through a mobile Pelabuhan application for tourists, as well as helping tourists to organize and carry out travel routines even when tourists want to have a solo vacation. However, further research is needed to ascertain the effect of the mobile guiding application on the fulfilment of information and education on the Ciletuh - Palabuhanratu Geopark to tourists. Furthermore, the experiences and attitudes of tourists who have used and assessed the M-Geopark application for tourism show that the application is easy to use as a medium of information and education. Therefore, we conclude that M-Geopark has a positive rating and has great potential for use in tourism.

12. Conclusion

Based on the achievements of this research, we can conclude that M-Geopark has helped tourists to obtain information and education from their tourism activities. The

guiding mobile application has been proven to support tourists, provide positive travel experiences and improve their attitudes towards tourism in the Ciletuh - Palabuhanratu Geopark area.

The findings also show that this approach can be useful and extended to other tourism fields. Regarding these empirical results, this study broadens our understanding of how to develop and integrate a mobile guiding application in the geopark area that affects incoming tourists.

From our experience in this study, we have identified the following difficulties and made recommendations to researchers, tourists, and practitioners about the integration of mobile guiding applications into tourism. Although this research implies a substantial improvement in guidelines for supporting tourism through mobile guiding in the Ciletuh-Palabuhanratu Geopark Area, this study also lacks in terms of generalization of the results. Because the research is conducted in geopark areas where the mobile guiding cellular technology is still in its early stages, the results may not be generalizable to other countries' tourism systems.

This study only focuses on the effect of using the mobile guiding application on tourists with general views and does not specifically consider the features and tools of mobile devices and the amount of time tourists spend on their tourism activities, all of which may have an impact on their travel satisfaction. The continued adoption of the mobile guiding system in accordance with the dynamic and evolving nature of the mobile communication system is necessary for future tourism arrangements. As the DSR process is cyclical in nature, future work will include refinement or upgrading of the M-Geopark system as our evaluation achievements.

M-Geopark has significant potential because we intend to have applications that support a variety of tourist objects, activities, and tourism contextualization. The contextual play-based aspect of learning is the next target of our work on the M-Geopark expansion.

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