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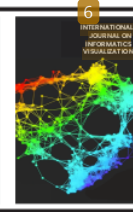
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The Utilization of Augmented Reality Technology for the Development of Tourism Information Media

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Abstract— The industrial revolution 4.0 has brought tourism trends using enriched interactive technology services. Technology in the world of tourism has helped the expansion of the industry through the promotion and mediation of independent tourists to carry out all services and transactions easily, including obtaining tourist information. This study aims to develop promotion media for geography education tourism in Soppeng Regency and test the effectiveness of the media. This study adopted the Alessi & Trollip learning multimedia development model. The developed media was tested on 20 respondents with 10-item usability scale statements and 5 response options ranging from agreeing to strongly disagree. The level of effectiveness of the media developed after being tested using the usability scale (SUS) system is included in the Good category (good) with an average score of 76.5. This level of effectiveness is included in the acceptable to users or acceptable category, with a grade scale of C and an adjective rating in the Good or good category. The results of this study also indicate that users are satisfied with the developed media but are not enthusiastic so that users can switch to other, more interesting media at any time. In the end, based on the final score obtained, it was concluded that the promotion media for geography education tourism in Soppeng Regency (battle city application) was effective and acceptable to users.

Keywords— Tourism information media; augmented reality; Alessi & Trollip model.

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I. INTRODUCTION

The tourism industry is considered one of the development tools that can assist the community in achieving various aspects of welfare, such as poverty alleviation [1]. Statistically, tourism positively influences economic growth and employment prospects in services and industry [2]. The presence of the tourism industry is proven to be able to create a chain of economic activities, encourage the movement of small to medium-sized enterprises, rejuvenate degraded ecological resources, provide alternative livelihoods for the perpetrators, and increase awareness of the use value of an area and the environment [3], [4]. As an industry, tourism is directly related to international trade, the preservation of the environment and cultural heritage, and the global movement of people [5].

Information and communication technology development has now reached various fields, one of which is tourism. Technology in the scope of tourism has helped the expansion of the industry through the promotion and mediating of independent tourists to carry out all services and transactions easily, including obtaining tourist information [6]. In line with

these technological developments, the demand for tourist information services is increasing and continues to urge sustainable tourism management [7]. It can be said that the tourism industry has benefited the most from the rapid pace of technological innovation that exists today. [8]

As the center point of Indonesia, Soppeng Regency has a unique value in becoming a leading tourist destination. The district, which is closely known as the city of Kalong or bats city, utilizes social media, including Instagram and Facebook, to promote its tourism objectives. Moreover, to realize the tourism industry's expansion, information technology is increasingly being encouraged. Until 2016, research was conducted at the Soppeng Regency Tourism Office to design a web-based tourism information system using the System Life Cycle method Development.

In light of this, the idea emerged to provide a novelty of tourism promotion media, exclusively in geography education tourism promotion media using the Alessi & Trollip model. In contrast to the Development Life Cycle Information System, which offers the web as a medium for tourism information, with the Alessi & Trollip model, a tourism

promotion media will be developed in the form of an application using cellular technology (smartphone).

II. MATERIALS AND METHOD

A. Relate Works

Some related studies used are referred to in this study. Bilotta et al. [9] regarding the industrial revolution 4.0 bringing tourism trends to the use of innovative technology services suitable for consumers using methods and technologies introduced by Big Data, Automation, virtual and augmented reality, and robotics and ICT. Berhanu and Raj [10] have studied the credibility of tourist information spread on social media platforms has a high level of trust in tourists aged 18-35 years and low at the age of 46 years.

Torney [11] has studied digital media and has driven a new approach to communicate geographic sites for tourism and education, with virtual reality depictions of geographic site areas providing an engaging experience for indirect interaction for users. While Dewi et al. [12] researched a system usability scale that is proven to be used in testing the feasibility of tourism applications related to recommendations for tourist destinations for prospective visitors.

Some other studies, such as Hidayat, Santosa, and Hidayah [13] investigated the system usability scale has been tested and can be used in usability testing of the use of e-learning in training. Finally, another scholar, Astawa [14] studied the advantage of augmented reality technology in tour: its ability to package tourism potential to make it more attractive and provide a different interaction experience.

B. Method

This research is a research and development using quantitative descriptive analysis techniques by adopting the [15] model. The development model consists of 3 attributes and three stages. The attributes referred to are standards, ongoing evaluation, and project management, while the intended stages are planning, design, and development [15]. The development stage begins with a brainstorming process to determine the boundaries and scope of the media duty for development.

1) *Research Site:* This research is located in Soppeng Regency, South Sulawesi Province, precisely in 3 tourist destinations, namely Lejja Hot Springs, Villa Yuliana, and Lembah Cinta (Matabulu Tourism Village).

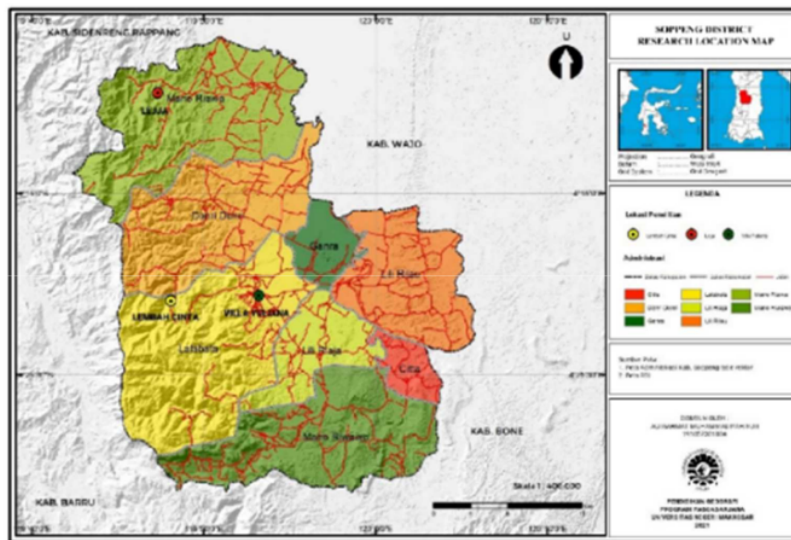


Fig. 1 Research location map

2) *Product effectiveness and usability assessment:* Assessment of product effectiveness and usability uses the usability scale (SUS) system developed by Brooke [16] with 10 statement items and 5 response options ranging from strongly agree to strongly disagree. The final score of the usability scale system is then adjusted to the measurement scale [14] in making the final decision regarding the usability of the developed media.

TABLE I
SYSTEM USABILITY SCALE (MODIFIED)

Modified SUS Statements

1. I think I will use this app again
2. I find this application complicated to use

3. I find this application easy to use
4. I need help from other people or technicians in using this application
5. I feel the features of this application work properly
6. I feel there are many things that are inconsistent in this application
7. I feel other people will understand how to use this app quickly
8. I find this app amazing
9. I feel there are no obstacles to using this application
10. I need to prepare myself first before using this app

The following are hardware and software used in developing promotion media for geography education tourism in Soppeng Regency.

TABLE II
LIST OF HARDWARE DEVELOPMENT MEDIA

Software	Function
ArcGis 10.8	Processing spatial data into new information in the form of maps
Blender	Creating 3D objects
Adobe Illustrator	Making markers and brochure designs
Adobe XD	Prototyping an App
Adobe After Effect	Creating animation
Unity3D & Vuforia	Creating augmented reality mobile media
Hardware	Function
Laptop Asus Intel Corei7 Ram 8GB	As hardware for operating system installations and other applications
Smartphone Xiaomi Redmi S2	Testing the media

The following are the analysis steps using the system usability scale (SUS) [17]:

- For odd-numbered statements, the score must be reduced by 1
- **4** the statement, even numbered is 5 minus the score
- Then multiply the total score obtained by 2.5 to get the total SUS final score
- Next determine the average score
- The last step is to determine the position of the usability level of the product using the measurement scale developed by [17].

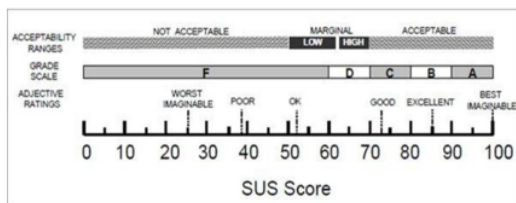


Fig. 2 Media acceptance rate by Bangor

III. RESULTS AND DISCUSSION

Generally, media development refers to the whole process of production, refinement, and validation. Allesi & Trollip introduces three stages of media development in their book: planning, design, and development. In contrast to other media development methods, Allesi & Trollip has three attributes that always accompany each stage of its development: standards, continuous evaluation, and project management. For example, at the design stage, these three attributes will always accompany that stage, such as determining the desired design standard, ensuring all designs are completed on target, and conducting evaluations regarding the appropriate design. And so on until the development stage, these three attributes will always accompany [15]

Project management is a crucial phase in the Allesi and Trollip model media development stage. Project management will coordinate and ensure all parts of the media are completed on time within the budget that has been provided. According to the case study of the development of tourism promotion media, the function of project management is to ensure that all parts of the media are completed according to the target. In this case, what is meant is making prototypes, preparing texts (making brochures and contents of tourist materials/information on each object), the readiness of

animated videos and audio, as well as other supporting materials such as 3D objects and pictures of tourist destinations.

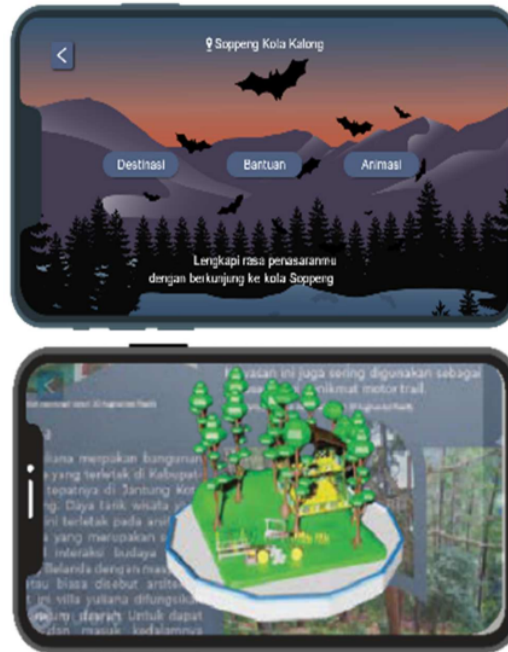


Fig. 3 Main Menu Display and 3D Object View

A. Development of Tourism Promotion Media for Geography Education Using the Alessi & Trollip Model

1) *Planning*: The planning stage of media development discusses the boundaries and scope of content about what products will be produced and who will use them. At this stage, a brainstorming process is carried out, looking for the root of the problem and the solutions offered to understand all kinds of obstacles that will be faced regarding the audience (the information they need), what technology will be used to convey media content, to how much budget is spent to make the program. The main matter in this planning stage is to determine the information and learning that the user will obtain. The brainstorming process directs the developer to look for similar media and illustrate the extent to which tourism promotion media in Soppeng Regency has developed, to get an overview and updates on the media to be developed.

2) *Design*: An essential flow in the design stage must be done by making flowcharts, storyboards, and prototypes. At the design stage, the developer focuses on the most important part that is directly related to the client, namely the making of storyboard designs and prototypes. Storyboards can show visual details of the media to be created [18]. It can be concluded that the storyboard is a pre-visualization of a media; in this section, an image of a media is created. From the brainstorming process carried out at the planning stage, it was found that tourism and learning information became the focal point that would be conveyed in the media later. Then a flowchart is made, as shown in Figure 4. The Flowchart

section is a stage that is not so important to be shown to the client. However, flowcharts play an important role in clarifying how to make storyboards. In contrast to storyboards, flowcharts only provide an overview or sequence of programs to be made. In the prototyping section, it is important to provide details and communicate the design. A prototype

describes how a program works. The visual representation, in this case, the prototype, can provide the best feedback from the client, so the prototype is the best way to communicate this [19]. Overall, the design phase deals directly with the client and how to develop ideas for the client [15].

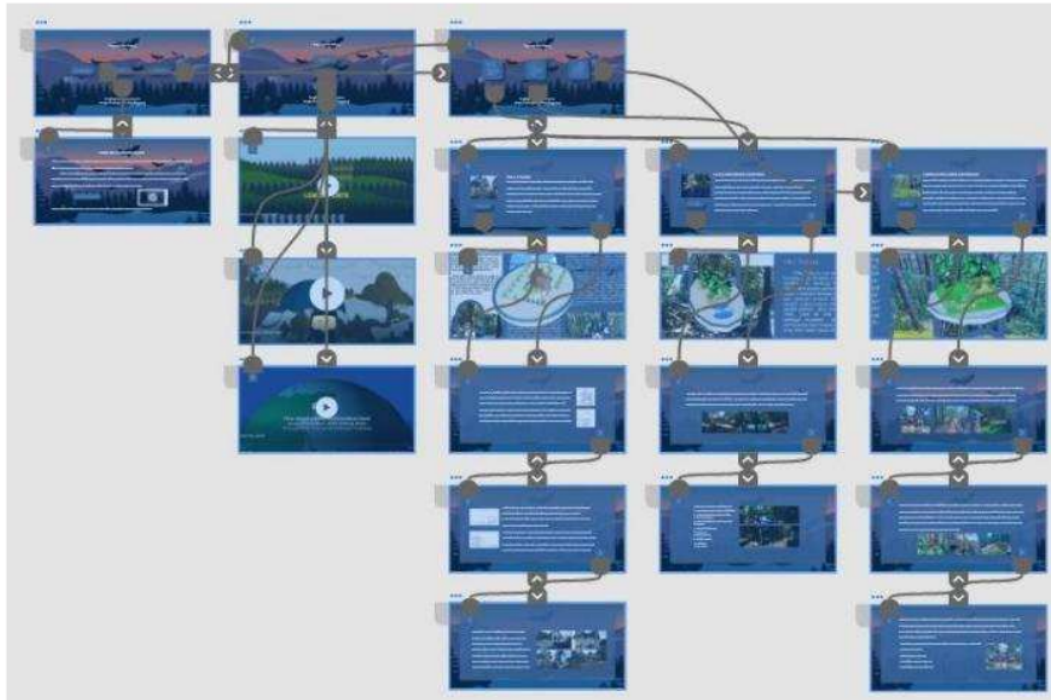


Fig. 4 Prototype

3) *Development*: In the development phase, the developer will communicate all aspects that have been done to the programmer team to then make the media according to the agreed prototype. At this stage, all media parts, be it brochures, markers, material content (tourist attraction information), graphics, audio and video animations, are provided.

The effectiveness of the resulting product will be tested through the stages of testing and revision until then validated and disseminated to tourist visitors. The two stages of the test carried out were the alpha test and the beta test. The alpha test is carried out within the scope of the design and developer team. In other words, the alpha test will involve media experts and material experts while the client carries out the beta test.

The standards that have been set in the manufacture of media, such as font style, color, graphics, look and feel, will be evaluated using an alpha test evaluation form. In other words, the alpha test focuses more on the functionality of the resulting media and ensures the product runs according to the prototype made before bringing it in. to the client. Based on what was found in the alpha test stage, further revisions will be made to eliminate the problems found. The beta test is a final product test by the client to be revised again before entering the last stage of media development, namely validation.

4) *Audio and Video Production*: Similar to the stages of media development, animated video production also goes through the stages of collecting references and making storyboards. Storyboard is one of the most important parts of making animation or motion graphics because it determines the quality produced [20]. Script creation is an equally important part of the animation video production stage. The script by the developer will then be converted using an online video maker into audio for use in animated videos as voice actors.

5) *Graphic Production (Brochures and 3D Objects)*: Graphic production related to brochures is filled with tourist attraction information, pictures, markers, and also maps of tourist attraction locations. In contrast to brochures in general, in this study, the developer provides a touch of interaction technology to fill out brochures in the form of markers. The marker functions as a user interaction tool to bring up a 3D view of each tourist attraction as well as learn animations

The planning stage of media development discusses matters related to the boundaries and scope of content about what products will be produced and who will use them. At this stage, a brainstorming process is carried out, looking for

the root of the problem and the solutions offered to understand all kinds of obstacles that will be faced regarding the audience (the information they need), what technology will be used to convey media content, to how much budget is spent to make the program. The main matter in this planning stage is to determine the information and learning that the user will obtain.

The brainstorming process directs the developer to look for similar media and illustrate the extent to which tourism promotion media in Soppeng Regency has developed, to get

an overview and updates on the media to be developed.

The interaction technology referred to in this video is augmented reality technology. This technology has been applied in various fields such as design, assembly, education, health, and also translation [21]–[23]. Apart from that, this technology has been used in many ways, one of which is communicating tourist attractions and cultural heritage (Vasileios Komianos). Basically, this augmented reality technology images 2D and 3D content as if it were real. In this study, what is displayed is 2D content, namely animation and text, as well as 3D content, namely the display of tourist objects in a low poly style.

TABLE III
THE RESULTS OBTAINED BY RESPONDENTS USING THE USABILITY SCALE SYSTEM

No	Statement										score	Score*2.5
Respondens	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10		
1	4	4	4	4	4	4	4	4	4	2	38	95
2	3	2	3	2	3	2	3	2	3	1	24	60
3	4	4	4	3	3	2	3	4	4	1	32	80
4	4	3	3	2	3	3	4	4	3	1	30	75
5	4	3	3	3	3	3	3	3	3	3	31	77.5
6	2	2	2	2	2	3	2	2	3	0	20	50
7	3	3	3	2	3	3	3	3	3	2	28	70
8	3	3	3	3	3	3	4	3	3	3	31	77.5
9	4	4	4	3	3	2	3	4	4	1	32	80
10	3	3	3	3	3	3	4	3	3	3	31	77.5
11	3	3	3	4	4	3	4	4	4	2	34	85
12	3	3	3	4	3	2	3	3	3	1	28	70
13	4	1	4	1	4	2	3	2	4	2	27	67.5
14	4	4	4	4	4	4	4	4	4	0	36	90
15	4	3	4	1	4	3	4	1	4	2	30	75
16	3	3	4	3	4	4	4	4	4	1	34	85
17	3	1	3	1	3	1	2	2	2	2	20	50
18	3	3	3	4	4	4	4	4	4	4	37	92.5
19	3	3	4	4	4	3	4	2	3	2	32	80
20	2	4	4	4	4	3	4	4	4	4	37	92.5
TOTAL											1530	
AVERAGES											76.5	

B. Effectiveness And Usefulness of Tourism Promotion Media Geography Education

Prior to usability testing, the application goes through a feasibility test stage by media experts. At this stage, the application will be declared eligible or not to be disseminated to users. Assessment is carried out on the functions of the developed application or media, including those related to functional correctness, functional completeness, and functional appropriateness. These three function assessments are standards that have been issued by ISO (International Organization for Standardization) 25010 regarding the suitability of product functions [24].

The following functions are referred to in the application:

- Functional correctness, every 3D object, and animated video appear above the brochure's marker or marker.
- Functional completeness, all functions can run to meet user needs, namely related to tourist attraction information and learning in it.
- Functional appropriateness, all functions can run well with easy and simple steps.

Regarding the truth and clarity of content, the assessment is carried out by a material expert, in this case, the Head of the Village Bumdes Mattabulu as the manager, the Head of PERUSDA (Regional Company) as the manager of the Lejja

hot spring, the BPCB interpreter for Yuliana's villa and lastly by a material expert related to geography. After the expert test stage has been carried out, it can be said that the product is feasible and ready for field testing related to the application's usability.

Based on the International Organization for Standardization (ISO) 9241-11, the stages of usability measurement include effectiveness, efficiency, and satisfaction. The interpretation of the average score of the usability scale system is divided into three interpretations according to the measurement scale [17], namely acceptability ranges, grade scale, and adjective rating. Acceptability range relates to the interpretation of the SUS average score into 3 levels of system acceptance by users, namely not acceptable (if the average score is 0-50.9), marginal (if the average score is 51-70.9), and acceptable (if the average score is 71-100). The adjective rating relates to the interpretation of the SUS average score in the form of numbers into adjectives: worst imaginable, awful, Poor, OK, Good, Excellence, and Best Imaginable. While the Grade Scale is the interpretation of the SUS average score into five grades, namely A (90 – 100), B (80 – 90), C (70 – 80), D (60 – 70), and F (Score < 60) [17].

From the table, it can be seen that the average score

obtained using the system is 76.5. This shows that the system or application developed is acceptable [12] users, with a grade scale of C, which is in the 70-80 value, and the adjective rating is in the Good or good category. The statement item System usability scale developed by John Brooke can measure the usability scale and effectiveness or learning ability of users [25], [26]. Statement items numbered 1,2,3,5,6,7,8 and 9 are used to measure the usability of a product while statement items numbered 4 and 10 are used to measure the learning ability of application users (applications can be learned easily). This is in accordance with the opinion [27] that the usability scale system, although it has shortcomings in assessing media efficiency, can be used to assess usability and ease of use. Meanwhile, according to [28], with a usability scale system the developer can determine the value of the usefulness of a media but has not been able to answer in detail what things must be done to increase its usability

Overall, the assessment shows that the user acceptance of the bat city application passes the marginal level that is acceptable, so it can be concluded that the bat city education tourism promotion media application is easy to use and learn (effective). The final usability result is because statement item 1,3,5,7,9 get a response from agreeing to strongly agree. The following statement 20 items are intended:

- I think I will use this system again
- I find this system easy to use
- I feel the features of this system work properly
- I feel other people will understand how to use this system quickly
- I feel there are no obstacles in using this system

From the SUS score obtained, it can also be determined the level of user satisfaction with the media by adjusting it using the net promoter score indicator, where a SUS score with a value of 90 or more indicates media users can become promoters while a SUS score with a value below 70 has the potential to make users a detractor [29]. Based on this assessment, the tourism promotion media developed is at the passive level (76.5) where it can be said that the media has received a good satisfaction response from users but does not show enthusiasm, so that at any time users can switch or move to try the product, or other more interesting media. This application is expected to help improve existing digital promotions in Soppeng Regency. The current era of digital transformation requires media in the form of android applications to increase tourism promotion and competitiveness [30], [31]

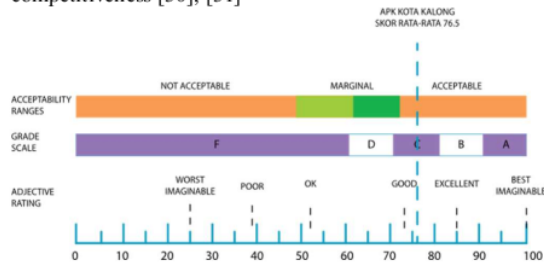


Fig. 5 Media acceptance rate by Bangor



Fig. 6 Net promote score Apk

IV. CONCLUSION

Development of tourism promotion media for geography education in Soppeng Regency by adopting the Alessi & Trollip model through 3 stages of development: planning, design, and development. At the media development stage, the design and development process requires continuous evaluation for the sustainability of the media. The most important thing in developing promotional media using this model is the existence of project management as an attribute. Project management will coordinate and ensure all parts of the media are completed on time and within the budget that has been provided.

The final decision based on the SUS calculation results and adjusted to the decision-making scale for the usability level stated that the effectiveness of the tourism promotion media for geography education in Soppeng Regency was in class C with an average usability scale (SUS) score of 76.5. Based on the class level, the tourism promotion media developed are at a good or acceptable level of effectiveness.

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