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Abstract. Edutourism is a tourism development model that combines fun and recreational tourism activities while still presenting educational values that can be done outside of school. UNESCO Global Geopark Batur, Bali, is one of the leading tourist attraction locations that can be developed to support edutourism activities., The COVID-19 pandemic has limited the public's ability to access geoparks and carry out edutourism activities. However, the number of internet users via smartphones in Indonesia continues to increase during the pandemic and encourages digital acceleration in all sectors, including education and tourism. This study aims to introduce and evaluate a mobile GIS application as a spatial data-based information media for the geopark area at UNESCO Global Geopark Batur Bali in a more exciting and informative way for edutourism. The study adopted ADDIE (Analysis, Design, Development, Implementation, and Evaluation) to develop and evaluate the mobile GIS application. The feature of the application provides edutourism itineraries, navigation, interpretive information, digital maps, guide route selection for users, geopark areas, geographical diversity, biodiversity, cultural diversity, tourist destinations, and geological disaster hazards map of the volcanic eruption of Batur. Additionally, the evaluation indicates that the application is categorized as appropriate to be used for edutourism purposes.

1. Introduction

Using a tourism activity as an education program is also known as Edu-tourism [1][2][3]. Edutourism model combines fun and recreational tourism activities while still presenting educational values that can be done outside of formal school. In edutourism, the audience and users are involved to travel to certain areas, which provides material to improve their understanding of certain subjects. Additionally, it is forecasted for students to expand their knowledge and information on particular topics and issues. Edutourism has been acknowledged as an essential strategy to enhance students' awareness [4]. Edutourism activities can provide opportunities for anyone to learn directly; therefore, edutourism is essential to enlarge students' knowledge [5][6][7]. The direct learning experience in the field, learning by doing an activity that is packaged in tour packages, can provide an unforgettable learning experience in nature for student tourists and children.

The existence of Geopark supervision can invite the people who live around it to play an active or passive role in preserving and improving the function of nature reserves that have unique geological, archaeological, ecological, and cultural values [8]. UNESCO Global Geopark Batur in Bali, is one of

the leading tourist attraction locations that can be developed in support of edutourism activities. The Batur UNESCO Global Geopark positioned in northeast Bali, Indonesia and nominated in 2012 as the first UNESCO Global Geopark (UGG) in Indonesia to launch a promotional program with a concept that balances geological, cultural and biological diversity undergoing the foundation of conservation, education, and sustainable development involving local communities. The Batur area has an area of 370.5 km^2, with an altitude of 920-2152 meters above sea level The Batur area has two main volcanic calderas and presents a unique volcanic landscape. From 1804 to 2000, Batur volcano has erupted at least 22 times, thus forming a strato-volcano [9]. Batur has a double caldera and a volcanic lake that is shaped like a crescent moon with a length of seven kilometers and a width of one and a half kilometers. Batur volcano is also known as the best caldera in the world [10]. The beauty and uniqueness, the endemic flora and fauna, and the indigenous culture of the Balinese people are an impressive combination [9][10].

In the last two year, the extant of Geopark and tourism sector in Indonesia have been hampered by the Covid-19 pandemic [11][12]. The Covid-19, the novel coronavirus, has driven the entire globe to a standstill. s a consequence, the government in the sphere has provided health distance policies to diminish infection. This policy implies to shut down public areas, transportation, education and tourism sites. In the positive matter from this pandemic has led people to be more creative by using technology. To deal with this situation, it has forced people to adopt the internet, and the number of internet users via smartphones in Indonesia continues to increase. The data from Wearesocial notes that the internet user in Indonesia has raised approximately 17 percent in the last two years. It also encourages digital acceleration in all sectors, including education and tourism. Nowadays, smartphones have become a vital part of fulfilling daily needs, especially in the era of the Covid-19 pandemic. In the era of the Covid-19 pandemic, smartphones are like things that cannot be separated from us because smartphones can provide what user want from entertainment, education, and much more that we can find in this digital media [15]. The number of smartphone users in 2018 in Indonesia is more than 100 million users and will certainly increase every year [16]. In Indonesia, adults with careers or jobs use smartphones for various needs, but teenagers also fulfil their needs using smartphones, especially during the Covid-19 pandemic [17]. In the tourism sector, technology is often involved in its activity. For example, it can be adopted in marketing purposes in the form of social media and virtual tour.

In the last decade, the sophisticated enlargement in geographic information system (GIS) technologies has driven the enhancement of a total of integrated global positioning system (GPS)/GIS applications [18]. This system can be adopted for the tourism industry and its development [18][19]. In detail, GIS enables to enhance the tourism sector by giving insights on location, areas' situation, trends and changes, routing through the site and resources usage patterns and balancing area sustainability and tourism [20]. For this matter, GIS has mainly been adopted in tourism development, from information kiosks and hiking maps to web-based maps [21]. As it allows the information movement to a vast network at the affordable budget line, the Internet is enlarging in popularity and matter. The Internet based GIS is more mobile, powerful, flexible and better able in sharing and communicating undergoing geographical knowledge [22].

To present, there is a lack of information system which presents geopark data based on mobile applications covering geosite, geoheritage, cultural diversity, biodiversity, geoconservation, accessibility of geotourism facilities that support edutourism activities. Therefore, this research aims to develop and evaluate the a mobile applications based on geographic information systems. The application offers the distribution of geosite locations, geoheritage, cultural diversity, biodiversity, geoconservation, accessibility of geotourism facilities, and maps of disaster-prone areas at UNESCO Global Geopark Batur, Bali. In addition, there are navigation functions, digital maps, site selection for user access guides, geopark areas, geosites, biodiversity, cultural diversity, tourist destinations, and edutourism travel scheme. The earmark people involving this application are guides, student tourists, academics at UNESCO Global Geopark Batur, Bali. This apps is expected to be a spatial data-based information media in more informative and exciting way for edutourism, especially in the pandemic era.

2. Methods

The method used in this study is the ADDIE model. ADDIE is one of the learning design models that has a systematic flow based on and developed on the basis of learning design theory. [23]. The concept of the ADDIE model that is applied to Sigatur, is used to build performance-based episodes that aim to develop learning spaces. Learning space is a term used in an environment that is deliberately set up for learning activities [23]. Intentional learning environments are complex, but we can provide a way to navigate that complexity with the ADDIE model. The application of ADDIE in the design of this instructional system will facilitate the complexity of the learning environment in responding to various situations [24].

This model covers five stages, including: analyzing, designing, developing, implementing, and evaluating. Analyzing: is the initial stage that must be carried out in the ADDIE instructional system design process to identify possible causes of non-performance and recommend solutions; Designing: is the next stage of the ADDIE instructional system design process, to verify performance objectives, learning assignments, and accessing strategies; developing: The further stage of the ADDIE instructional system designing process, with the aim of generating and validating training substance. The fourth step of the ADDIE instructional system design process aims to conduct training. The last stage is evaluating, which is intended to assess the quality of the training materials before and after implementation and the instructional design steps adopted to provide instructional outcomes [25]. Additionally, the development application involves primary data from the questionnaires toward the user requirements for tourism enhancement. Further, the application was evaluated by expertise in the field to ensure that it can be used for general purposes.

3. Results And Discussion

3.1. Media specifications

The Batur UNESCO Global Geopark information system based on this Android mobile app is called Sigatur. This application offers geopark data based on mobile applications that are equipped with comprehensive information related to geosite, geoheritage, cultural diversity, biodiversity, geoconservation, accessibility of geotourism facilities, and maps of volcanic hazard areas, navigation, interpretive information, digital maps, geopark areas, tourist destinations and itineraries for supporting edutourism. The primary idea of this application is designed to be easy to use, fun, and educational, especially for tourists from among students and public. The application allows user to obtain information through interactive media in delivering edutourism substance about Batur UNESCO Global Geopark.

3.2. System Implementation and Testing

This section discusses System Prosecution and examination. System implementation is the process of translating application development needs into a software representation, following with the evaluation results that have been carried out. After the prosecution of the new system, it will be examined where the shortcomings and advantages. These advantages and disadvantages will be known in new applications for further system enhancement and improvisation.

The main aim of implementing the system is to make it easier to propose the module manual to all users who will adopt the system. Users can acknowledge what is provided on the system and promote input to system makers as an attempt to give some enhancement and improvise better system skills. The minimum requirement to install the Sigatur App is illustrated in Table 1.

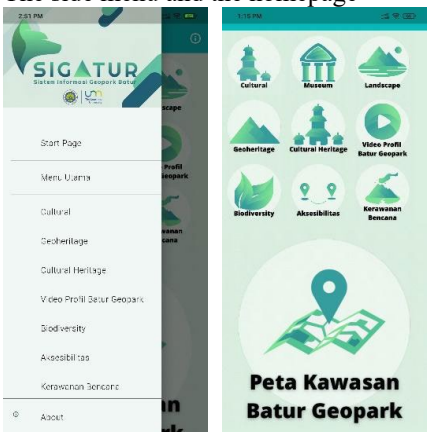
Table 1. Hardware Requirements

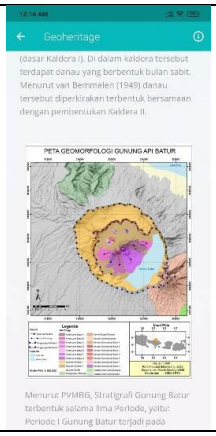
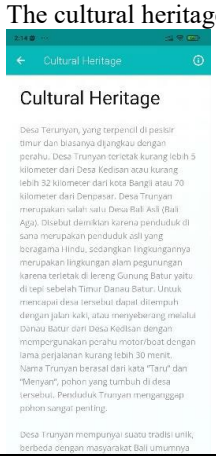
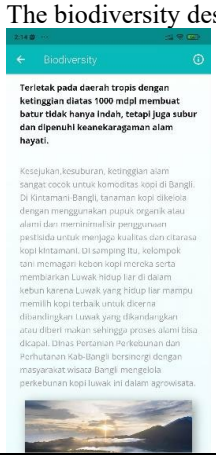
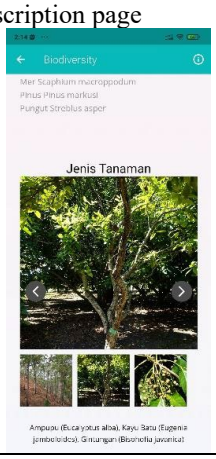
Hardware	Specification	Device
Screen	7”	
RAM	4 GB	Android Mobile
Storage	128 GB	
Operating System	Android 11	

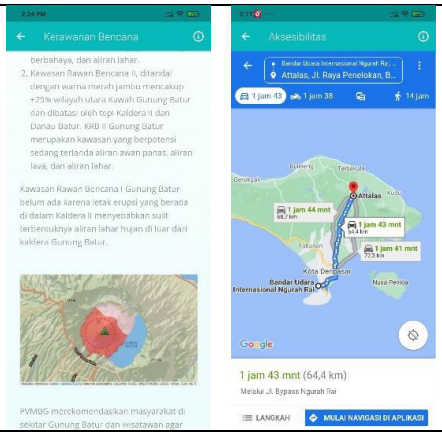
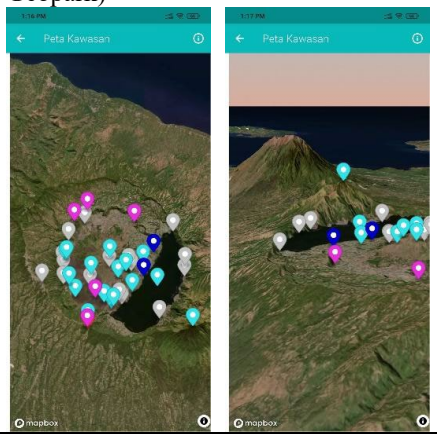
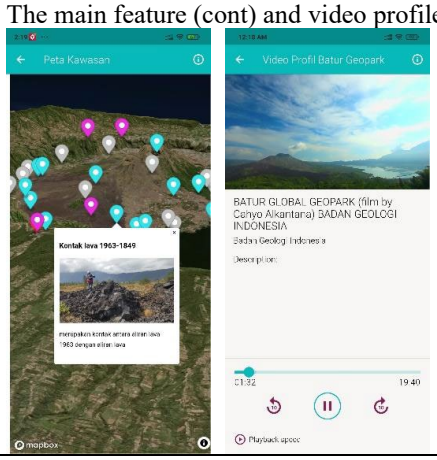
3.3. Interface

The interface design application is provided into a system built undergoing software described in the software implementation sub-section. Some parts of the interface that have been implemented are presented in Table 2.

Table 2. Interface and Description of the Application

No	Interface	Description
1	Open the application (Sigatur) on the Smarphone and the Loading Page 	The mobile phone application was built with an Android platform, and the process of starting application requires the internet.
2	The side menu and the homepage 	This window show the main ten features that can be use in the app. The Cultural, Museum, landscape are an image slide show. Geoheritage, Cultural Heritage, Biodiversity, and "Kerawanan Bencana" are page that consist with description and image.
3	The geoheritage desciption page	At this page, the content shows about the special physical

	 	condition of mount Batur
4	The cultural heritage description page  	This cultural heritage page consists of a uniqueness of the social condition in the Batur Cultural Heritage Area
5	The biodiversity description page  	Biodiversity page is the page that inform about the unique condition of flora and fauna in Mount Batur Area
6	Hazard vulnerability (left) and accessibility (right)	The hazard vulnerability page informs to users about the potential risk that can be happen on this area. On the accessibility

		page it will interface to google maps so users can track which way and how long the trip to Mount Batur
7	The main feature (Peta Kawasan Batur Geopark) 	On this page, users can see the satellite image about the Batur Geopark Area that can look on 2D and 3D model
8	The main feature (cont) and video profile 	The main map also has some ticks that if users touch then the map will fly to that ticks and show the additional information on the pop-up ballon.

3.4. Media Usability Estimation

The validation or application examination phase is processed quantitatively and qualitatively. Quantitative assessment is carried out by material and media experts in the Universitas Negeri Malang with the total two people with doctoral degree in the field of study. In this phase, initial testing (design verification) by material and media experts is carried out before testing is carried out. A qualitative assessment was carried out to guide application products undergoing the “Black-Box” method and questionnaires to tourists. The materials and appearance of the application must be ensured that they are appropriate and suitable for use. This calculation uses a Likert scale from a scale of 0 to 4. The

results of the estimation process are shown in the media feasibility score table. The interval was determined using an expression with a maximum score of 4 and a minimum score of 0. The Likert scale was adopted to calculate the score for each interval from the statement given to the participant. Table 3 is the result of evaluating the test against the user using each variable.

Table 3. Category for Estimation

Class Interval	Categories
3-4	Excellent
2-3	Good
1-2	Poor
0-1	Bad

3.5. Material expert verification

Lecturer in field tourism does a material expert in enlarging this application. The findings also followed an expert assessment of data material for mobile developed GIS applications provided with four categories. From the preliminary calculation, the material experts summarize that the data and information provided in the application per the assessment of 82.93% were considered excellent, and 17.07% were in a good category (see Table 4). In detail, the evaluation indicate that the application can be used for user as it has the category good and excellent.

Table 4. Distribution of material expert assessment

Categories	Class Interval	Frequency	Total	%
Excellent	3-4	12	44	82.93
Good	2-3	3	9	17.07
Poor	1-2	0	0	0
Bad	0-1	0	0	0
		15	53	100

4. Conclusion

Based on the assessment results on the application menu display using black-box testing, it can be concluded that the functionally built application has produced the expected output. Meanwhile, material expert validation is included in the excellent category for application operation, both content and appearance. Furthermore, the opinion of experts during the use of the application is positive and mentioning that the application covers the user requirement for edutourism purposes. It implicates that the application can be adopted for helping edutourism activities. It is expected that this research may trigger further studies on information systems based on GIS and mobile apps in other Geopark in Indonesia.

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References

[1] A. Holdnak and S. M. Holland, “Edu-tourism: Vacationing to learn.,” *Park. Recreat.*, vol. 31, no. 9, pp. 72–75, 1996.

[2] H. Gibson, “The educational tourist,” *J. Phys. Educ. Recreat. Danc.*, vol. 69, no. 4, pp. 32–34, 1998.

[3] O. A. D. Vieira, "Developing edu-tourism in an urban indigenous community: the case of Aldeia Bananal (Brasília–DF–Brazil)," *Int. J. Tour. Anthropol.*, vol. 6, no. 2, pp. 133–153, 2018.
[4] N. Nasruddin, E. Normelani, and R. Kumalawati, "Strategy for the Development of Kampung Sasirangan as Edutourism Village," *J. Indones. Tour. Dev. Stud.*, vol. 7, no. 3, pp. 205–210, 2019.
[5] C. Smith and P. Jenner, "Educational tourism.," *Travel Tour. Anal.*, no. 3, pp. 60–75, 1997.
[6] D. R. Ma'rifah and I. G. P. Suryadarma, "Penyusunan panduan edutourism Hutan Wisata Tlogo Nirmolo guna memunculkan karakter peserta didik kelas X," *J. Inov. Pendidik. IPA*, vol. 1, no. 2, pp. 126–137, 2015.
[7] R. S. Hayati, "Edutourism Taka Bonerate National Park through scientific approach to improve student learning outcomes," in *Journal of Physics: Conference Series*, 2017, vol. 812, no. 1, p. 12023.
[8] S. S. Andriany, M. R. Fatimah, and A. Hardiyono, "Geowisata Geopark Ciletuh: Geotrek Surrounds the Beauty of the Ciletuh Mega Amphitheater (The Magical of Ciletuh Amphitheater)," *Bull. Sci. Contrib.*, vol. 14, no. 1, pp. 75–88, 2016.
[9] Badan Pengelola Pariwisata Batur Unesco Global Geopark (BUGG), "Geodiversity," 2017. [Online]. Available: https://www.baturglobalgeopark.com/index.php/profil/25/Geodiversity.html.
[10] unesco.org, "BATUR UNESCO GLOBAL GEOPARK (Indonesia)," 2017. [Online]. Available: https://en.unesco.org/global-geoparks/batur.
[11] P. Harchandani and S. Shome, "The effects of COVID-19 on global tourism," *Asean J. Hosp. Tour.*, pp. 63–82, 2021.
[12] B. M. Eppang, A. P. M. Som, M. Azinuddin, S. Rijal, and M. Ridwan, "The Impacts of the Covid-19 Pandemic on the Tourism Economy in South Sulawesi, Indonesia," *Psychol. Educ. J.*, vol. 58, no. 2, pp. 2613–2624, 2021.
[13] A. Woodward, "Wuhan, China, is about to be quarantined as the coronavirus outbreak grows. The city has 3 million more residents than New York City," *Business Insider*, 2020. [Online]. Available: https://www.businessinsider.in/science/news/wuhan-china-is-about-to-be-quarantined-as-the-coronavirus-outbreak-grows-the-city-has-3-million-more-residents-than-new-york-city-/articleshow/73532915.cms.
[14] WHO, "Breaking Coronavirus Disease #COVID19 #Coronavirus," *2020*. [Online]. Available: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/events-as-they-happen.
[15] T. Fidowaty, R. Prastamawati, F. M. Subekti, D. Klarado, and N. P. Dewi, "The Utilization of Digital Device during Pandemic Era," *Int. J. Educ. Inf. Technol. Others*, vol. 4, no. 3, pp. 378–384, 2021.
[16] M. K. K. Singh and N. A. Samah, "Impact of smartphone: A review on positive and negative effects on students," *Asian Soc. Sci.*, vol. 14, no. 11, pp. 83–89, 2018.
[17] L. Kibona and G. Mgaya, "Smartphones' effects on academic performance of higher learning students," *J. Multidiscip. Eng. Sci. Technol.*, vol. 2, no. 4, pp. 777–784, 2015.
[18] T.-H. Chu, M.-L. Lin, C.-H. Chang, and C.-W. Chen, "Developing a tour guiding information system for tourism service using mobile GIS and GPS techniques," *Adv. Inf. Sci. Serv. Sci.*, vol. 3, no. 6, pp. 49–58, 2011.
[19] N. Shoval and M. Isaacson, "Tracking tourists in the digital age," *Ann. Tour. Res.*, vol. 34, no. 1, pp. 141–159, 2007.
[20] R. Butler, "Alternative tourism: The thin edge of the wedge," *Tour. Altern.*, pp. 31–46, 1992.
[21] E. Duran, D. Z. Seker, and M. Shrestha, "Web based information system for tourism resort: A case study for side/manavgat," *Proc. XXth Int. Soc. Photogramm. Remote Sensing, Istanbul, Turkey July*, pp. 12–23, 2004.
[22] N. Colas, B. Houston, L. Warnecke, and R. BROWER, "Internet-Based GIS for Local Government: A Non-technical Guide to Planning and Implementing an Online Geographic Information System," *Cayuga Cty. Plan. Dep. New York. Accessed*, vol. 6, no. 07, p. 6, 2000.
[23] R. Arrasyid, F. Urfan, M. Ruhimat, I. Setiawan, and D. S. Logayah, "Mobile gis app for guiding geopark at unesco global geopark ciletuh palabuhanratu, indonesia," in *IOP*

Conference Series: Earth and Environmental Science, 2021, vol. 683, no. 1, p. 12109.
[24] E. Widyastuti, "Using the ADDIE model to develop learning material for actuarial mathematics," in *Journal of Physics: Conference Series*, 2019, vol. 1188, no. 1, p. 12052.
[25] H. Jung, K. Lee, and W. Chun, "Integration of GIS, GPS, and optimization technologies for the effective control of parcel delivery service," *Comput. Ind. Eng.*, vol. 51, no. 1, pp. 154–162, 2006.