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### Winter 2022 Volume XIII Issue 7(63)

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### Call for Papers Spring Issues 2023 Journal of Environmental Management and Tourism

**Journal of Environmental Management and Tourism** is an interdisciplinary research journal, aimed to publish articles and original research papers that should contribute to the development of both experimental and theoretical nature in the field of Environmental Management and Tourism Sciences.

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### Reporting of Endangered Animals at Tourist Destination Locations using Self-Reporting Applications

Marvin Chandra WIJAYA Maranatha Christian University, Indonesia marvin.cw@eng.maranatha.edu

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#### Abstract:

Many tourist destinations in Indonesia are nature reserves, forests, beaches, and other natural attractions. In these tourist destinations, there are usually endangered species. Meanwhile, the Center for Nature Conservation in Indonesia requires mapping data for endangered animals. Mapping is costly and time-consuming. In this study, a system that involves tourists in mapping endangered animals is proposed. Application was developed to create an endangered animal reporting system. This application can be used on Android-based smartphones. This application has four features: Event, Gallery, Report, and Message. This application also has an educational function about endangered animals. Overall this application is rated positively by its users (tourists and tourist destination management). This app is rated 4.5 (Likert scale) by tourists and rated 4.2 by tourist destination managers. Photographs of endangered animals reported by tourists managed to process and map endangered animals.

Keywords: endangered animals; self-reporting; detection.

JEL Classification: O33; Q59; Z32.

#### Introduction

Indonesia is a country located in Asia which is flanked by two oceans (Pacific Ocean and Indian Ocean) and flanked by two continents (Asia Continent and Australia Continent). Currently, Indonesia is one of the tourist destinations for both local and foreign tourists (Mayuzumi 2019). One of the tourist attractions in Indonesia is its abundant natural wealth (Krisnawati *et al.* 2021). Tourist destinations in the form of the environment such as forests, nature reserves, beaches, mountains, fields and many others (Nugroho *et al.* 2022; DAMIASIH *et al.* 2022). Currently, many tourists who come here to come to natural attractions (Huerta-Mendoza and Fischer 2022). Meanwhile, there are many endangered animals in these tourist destinations. Endangered animals face many threats, such as bad tourist behavior, bad environment, loss of care and many more (Venter *et al.* 2022). Tourists as visitors to tourist destinations can participate in environmental preservation (SUARDI *et al.* 2022). These two things must be in harmony, where tourism can continue and the protection of endangered animals can also be carried out. One of the conservation of endangered animals is by mapping endangered animals (Dobson *et al.* 1997). This mapping requires considerable time and cost. Innovations can be done by involving tourists to report independently if they detect an endangered animal. This process should not be carried out in the short term but within the framework of preventive conservation. Preventive conservation involves many parties including tourism actors and is carried out in the long term (Wilson *et al.* 2011).

#### 1. Literature Review

Some animals have a habit of migrating at certain seasons. The migration of these animals can invalidate the mapping of animals, especially endangered animals. Various methods have been used to detect animal migration and have been studied by various researchers.

D. M. Baasch in 2022 conducted a study to track bird mitigation using ultraviolet light. Sometimes, the mitigation bird hits a tower or electricity pole (Baasch *et al.* 2022). In the study, ultraviolet light was used to guide bird mitigation. The bird mitigation detection system should be built over a vast area. An area measuring 260 meters x 100 meters with a height of 35 meters was constructed to detect bird mitigation, as shown in Figure 1. This system successfully detects and tracks bird mitigation correctly. The disadvantage of this system is that it requires a large area and must be constructed in many places.



Figure 1. Collision Avoidance System's field (Baasch et al. 2022)

J. A. J. Castaneda made detection of endangered mammals in the Philippines (Castan<sup>e</sup>da *et al.* 2022). In this study, YOLOv5n was used to detect animals on the island of Negros. The system built in the study is shown in Figure 2. Detection using CCTV cameras installed in certain places. Data from CCTV is taken by the Raspberry Pi camera module and processed by the Raspberry Pi 3B+.





The dataset used is 1,446 animal images, with 1,012 used as training images and 434 used as test images. YOLO is part of a neural network that has a backbone, neck, and head model and uses a Cross Stage

Partial Network. This system has advantages in terms of fast processing time. The measurement metrics use the Precision, Recall, and F1-score indicators that use true positive, true negative, false positive, and false negative data on the test results. The system tracked several endangered mammals (Visayan leopard cat, Visayan spotted deer, Visayan warty pig, and Malayan civet) with  $\pm$  90% accuracy.

A. W. Bartlow conducted a study to model the distribution of endangered animals and relate them to geographic factors (Bartlow *et al.* 2022). Based on the research results, the distribution of endangered animals relates to geology, topography, and weather. Data on endangered animals are taken from data collection taken from various sources. The amount of data taken is 650 endangered animals (Salamanders) from the Global Biodiversity Information Facility. The data is modeled using Maxent to find the distribution of these endangered animals.

S. Kahl in 2022 carried out the detection of endangered birds using soundscape recordings (Kahl *et al.* 2022). The four endangered bird species Nene, Akiapola au, Alawi, and Liwi are one of the test data sets in the study. In total, 152 endangered bird species become the data set with 14,800 sound recordings. The record length for testing in this study totalled 90 hours. Overall, using neural networks has succeeded in detecting endangered bird species. This system is very good at detecting bird species, but it is not easy to record bird sounds in the wild.

#### 2. Methodology

In this study, we propose a system using an information system that is implemented on a mobile application. The mobile application can record, report, and map endangered animals. The reporting system can be used by many people, including tourists who visit tourist attractions in the natural environment. The software development life cycle is the steps that can be applied in application development (Kaliappan and Ali 2018). This study uses five steps to create such a system, as shown in Figure 3.



Figure 3. Five steps of system creation

The first step is the analyst's requirements regarding the condition of society in Indonesia. Knowledge or information about endangered animals in Indonesia is currently not very widespread. It is customary in Indonesia that when someone sees an animal that is considered an endangered animal in Indonesia, that person does not know that the animal is a rare species. Therefore, the system must be able to educate people using the application about the types of endangered animals. In addition, the application must be able to capture photos of threatened species, send the photos to the server, and process them to map each detected endangered animal.

The system's design consists of two parts: an education section for users or tourists and an endangered animal reporting section. At first, the application made must be able to be personalized with the user's account. The education section must be able to display pictures of endangered animals and be able to display explanations about these species. Application design mockup in the personalization section and the education section, as shown in Figure 4.



Figure 4. Application design mockup in the personalization section and the education section

The endangered animal reporting section consists of a page for taking photos of endangered animals, either from the front or the other side. The photos and location where the photo was taken will be reported to the server and processed for mapping of endangered animals. The reporting section design mockup is shown in Figure 5.



Figure 5. Endangered animal reporting section

The application is designed to be used by all ages, including children. The ease of using this application is very crucial so that tourists do not feel burdened but can instead enjoy using this application. The application has the following limitations:

- Application users cannot chat between users/users with other users.
- The application cannot be accessed based on the website.
- During offline mode, the application will still be accessible, but the system will not update. The system will be automatically updated (synchronized) when in online mode.
- Mobile devices must use android OS.
- Analyzed and designed the system based on mobile device (De Lara et al. 2003).

This application is not only a media for displaying information on endangered animals, but there are additional chat features and sending pictures/videos between the user and the government agency to preserve endangered animals in Indonesia. This feature is an effort to facilitate reporting related to the existence of endangered animals that will be submitted to government agencies for preservation. To make it easier to report locations, there will be a Maps feature that is integrated with Google Maps.

#### 3. Experiments and Discussion

The application was tested on 40 visitors to a tourist destination. The developed application has not been associated with the play store, so the application installation process is processed manually. The application's installation file (APK) is sent to the traveller's smartphone and then installed one by one. In the testing process, tourists are explained how to use the application and can then use the application independently.

The developed application is shown in Figure 6. Each user has their own account with their own profile. The application generally has four features: Event, Gallery, Message, and Report. Feature Event provides

information about the existence of activities related to endangered animals. Gallery not only displays photos of species but also includes detailed explanations as learning materials.



Figure 6. Application interface

Figure 7 shows the process of sending photos from the user to the server. The server will process the photo into a distribution map for each species reported by the user. The distribution map display is not only on the user's smartphone but will also appear on the backend of the server.



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In order to increase user participation in protecting endangered animals, a reputation and reward system is created for each registered user. Figure 8 shows a backend display regarding rewards and reputation for a user.





The survey was distributed to tourists and tourist destination management who have used the application. The number of respondents from application users is 30 people, and from tourist destination management is 5

people. The survey was made using a Likert scale (1-5). Table 1 shows the survey results from tourists, and table 2 shows survey results from the tourist destination management.

	Very Unsatisfied (1)	Unsatisfied (2)	Neutral (3)	Satisfied (4)	Very satisfied (5)
Ease of use	0	0	0	2	28
Educate	0	0	5	15	10
Reporting system	0	0	2	15	13

Table 1. Survey results from tourist

Table 2. Survey results from tourist destination management

	Very Unsatisfied (1)	Unsatisfied (2)	Neutral (3)	Satisfied (4)	Very satisfied (5)
Ease of use	0	0	0	1	4
Educate	0	0	2	2	1
Reporting system	0	0	2	1	2

The survey results show that the developed application received a positive response. Surveys aimed at tourists scored: Ease of use = 4.9, Educate = 4.2, Reporting system = 4.4. The survey aimed at tourist destination management scored: Ease of use = 4.8, Educate = 3.8, Reporting system = 4. Figure 9 shows the results of the survey.



In general, the applications developed are rated positively by their users. Tourists who use this application give an average rating of 4.5, and the management of tourist destinations gives a rating of 4.2. The ease of use of this application is rated very high at 4.9. In addition, this application is also considered good in terms of education about endangered animals, with a value of 4.1. This application is also considered successful in terms of reporting endangered animals found by tourists.

#### Conclusion

A system was developed to allow tourists to participate in the protection of endangered animals. The system is made into an android-based application. The application has four features: Event, Report, Gallery, and Message. Tourists have successfully used this application to report endangered animals that have been found in natural tourist destinations. This application is rated positively by its users. Tourists give a score of 4.5 using a survey with a Likert scale and a value of 4.2 by the management of tourist destinations.

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