MANFORSERV (Mangrove Forest Conservation) Application Design with WebGIS Technology

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Abstract. The total area of mangrove forests in Indonesia is 25% of the total world-famous mangrove forests along 100,000 kilometers of coastline. Handling that can be done is to rebuild and restore the mangrove forest itself. The existence of GIS (Geographical Information System) provides a solution to overcome this problem. The GIS concept used includes spatial analysis in determining the location for planting coral reef forest seedlings in accordance with environmental characteristics. The GIS concept is implemented through an online mangrove seed donation system. The purpose of this research is to design an online donation system based on GIS. The method applied was the descriptive method and action (action). In designing the system, the methods used were object-oriented approach and prototype development methods. With this research, a system will be produced in the form of an online donation application in carrying out mangrove forest conservation, making it easier for people to conserve mangrove forests in Indonesia.

Keywords: Mangrove forests, GIS, MANFORSERV, Object-oriented.

1. Introduction

Indonesia is an archipelagic country with a coastline of nearly 100 thousand kilometers currently threatened by high sea levels due to climate change. This high sea level in many areas has resulted in erosion and abrasion. One of the supporting factors for abrasion and erosion in coastal areas is the destruction of mangrove areas. Most of the damage was contributed by human activities [1]. Overexploitation by cutting down mangrove forests is often done by the community. In addition, excessive land-use often occurs, namely opening new land by utilizing land overgrown with mangrove forests as agricultural land, plantation land, residential areas, jetty buildings, and various mining activities and other buildings increasingly prevalent in coastal areas. The importance of restoring and protecting mangroves is an effective effort to anticipate the possibility of erosion, abrasion, land subsidence, and the greatest impact is the occurrence of floods and tsunamis. Restoration and protection of mangroves are also urgently needed to anticipate natural damage that impacts the community.

Several studies that have been carried out in the manufacturing/application system aimed at preserving mangrove forests are research conducted by Fathurrohmah [2]. This study aims to manage mangrove forests through remote sensing applications and Geographic Information Systems (GIS). However, the research conducted focuses on the distribution of mangrove forest locations only without involving the community in preserving the mangrove forest itself. Another research is the application of classification of mangrove plant species based on morphological criteria by Sistria [3]. This research produces an application in determining the types of mangrove plants. This research will support the design of an online donation application to determine the types of mangroves that can be planted in every area in Indonesia. The other research is mangrove forest cover change along the coast of East Lampung Regency). This study helps determine the factors that trigger changes in mangrove forest cover. The resulting research can assist in describing the distribution of mangrove forests using the GIS system. This research can support the application of GIS in the Online Donation application [4].

Therefore, it is seen from the very important value of mangroves, and to complement the research that has been done and to increase public awareness of the importance of preserving mangrove forests, the community must have easy access to efforts to conserve mangrove forests so that in the end people can participate directly towards the preservation of the mangrove forest. Researchers provide facility solutions that make it easier for people to preserve mangrove forests directly through technology based on Geographical Information Systems (WebGIS). The facilities offered are the provision of appropriate mangrove forest conservation services based on the characteristics of the planting location in the form of a mangrove forest seed donation system. The mangrove forest seed donation system's service is carried out through electronic media connected to the internet, which is commonly called an online service. It is called a GIS-based donation system (Geographic Information System). Researchers named this mangrove donation system service as webGIS "MANFORSERV" (Mangrove Forest Conservation). The location-based mangrove seed donation system on webGIS will make it easier for people who want to participate in mangrove conservation but do not have enough knowledge and the opportunity to plant mangrove seedlings directly in areas where mangroves can be planted. With this webGIS, the community can easily participate in saving mangroves so that the conservation process of planting mangrove seedlings can be carried out sustainably, and it is hoped that the amount of mangrove damage can be reduced.

2. Method

2.1. Research Method

In building a system, to support this research used descriptive and action research methods. The description of this method is shown in Figure 1.
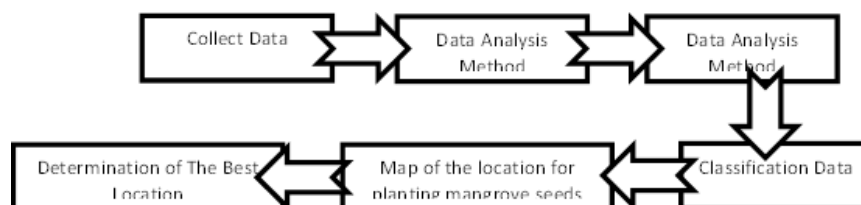

Figure 1. Research Method[5].

1. Data Collection
    Data collection through primary data. The primary data source of this research was obtained from observations and interviews from the Forestry Office [5].
    a. Direct Observation (Observation
        Observation activities include carrying out the systematic recording of events, behavior, objects seen, and other things needed to support the research being carried out. In this study, researchers made direct observations at the West Java Provincial Forestry Office[5][6].
    b. Interview
        In this case, the researcher conducted direct questions and answers to employees at the West Java Province Marine and Fisheries Service regarding the issues discussed, namely the conservation licensing process, mapping, and performance assessment of the West Java Provincial Forestry Service. The interview is conducted to clarify and convince the facts or information obtained through observation.
    c. Literature review
        The initial stage of data processing is to know the types of mangroves in Indonesia by accessing the page https://ilmugeografi.com/?s=mangrove/jenis-jenis-mangrove. After knowing the types of mangroves in Indonesia, the IUCN website searches for the distribution of mangrove species through the URL http://www.iucnredlist.org.
2. Data Analysis Method
    The data analysis method used is an object-oriented approach. The analysis method will be described through Use Case Diagrams, Activity Diagrams, Sequence Diagrams, and Object diagrams.
3. Selection of Mangrove Types
    For the selection of mangrove species obtained through existing data at the West Java Forestry Service. This is because the data is a monitoring report that has been reported by each region in Indonesia each year for the distribution of mangrove forests
4. Map of the location for planting mangrove seeds.
    To determine the location for planting mangrove seedlings using GIS. The application of this GIS is to make it easier to visualize mangrove locations. There are two types of images used in this GIS, namely red images and green images. The red image shows that the location is a priority for mangrove planting due to damage to mangrove distribution, while for the green image, the distribution of mangroves is in good condition.

2.2. Systems Development Method

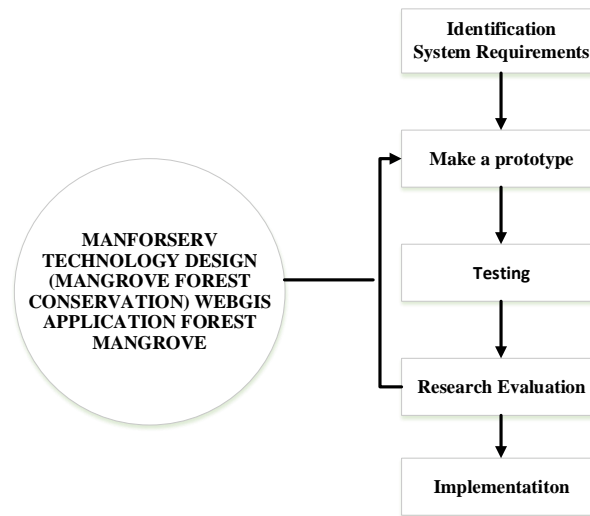The system development method used in the prototype development method is shown in Figure 2.

Figure 2. System Development Method [7]

The system development method used in this study is developing a spiral system on the grounds that the spiral development method of users and system developers alike can understand the risks and shortcomings of a constructed system.

The following are activities carried out in accordance with the method of developing a spiral system:

Identify system requirements. The researcher plans on the activities to be carried out and plans for the stages and the research data needed.

1. Identify system requirements.
    Identification of needs is carried out in 3 stages: interviews, observation, and documentation collection. This is done with the system's aim to be adjusted to the data collection carried out. Moreover, the data collected is used as a tool for analysis and testing of the system [8].
2. Make Prototype.
    This stage consists of 3 stages, namely creating a database design. This design aims to build tables that will be linked with the application being built. The table created is used for data storage, for processing application functions, and processing reports. The second is to design an interface. This is intended to describe the general process of what the application will be built on. At this stage, it can be adjusted according to the wishes of the user. In this case, the users are the community, the Forestry Service, and Mangrove Farmers. The third is making program code to build application functions into the interface that has been created [8].
3. Testing
    The test applied in this stage uses black-box testing, including testing functions, interfaces, inputs, processes, and software outputs according to the required specifications [8].
4. Research Evaluation

For this stage, an evaluation is carried out by applying it to the community or where the research is carried out. Each community will be given an application that can be accessed so that users can be done directly. Evaluation is given through a questionnaire given with several questions related to the application function being applied. The public can provide criticism and suggestions for existing applications so that the input provided by the community is used as a benchmark in improving further applications.

5. Implementation

The implementation stage is when the online donation application is applied to the forestry service, mangrove farmers, and the community. The implementation stage is carried out after going through the application testing process. The application to be implemented is in accordance with the needs of application users.

3. Results and Discussion

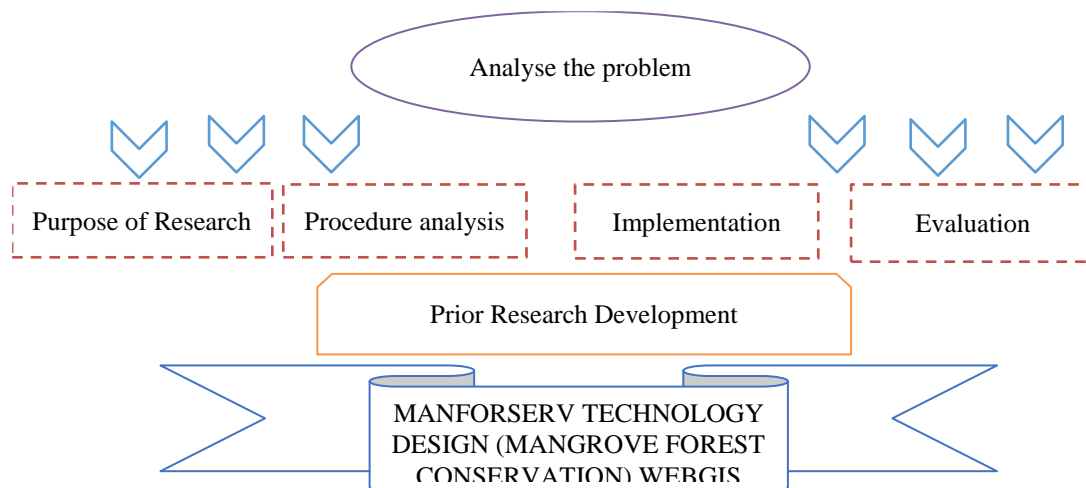Based on the problems that occur, the plan described is carried out with several considerations, as shown in Figure 3.

Figure 3. Result And Discussion [5]

3.1. Purpose of Research

To help the community through an online donation application in planting mangrove seeds by people who do not have the knowledge and opportunity to do conservation by planting mangrove seeds directly but can be donated and planted through farmers, in critical land areas that require planting mangrove forests so they can together participate in the conservation and monitoring of Mangrove Forests.

3.2. Procedure Analysis

The depiction of the analysis procedure was carried out through a use case diagram. This is intended to make it easier to describe the process to be created in the application, as shown in Figure 4.
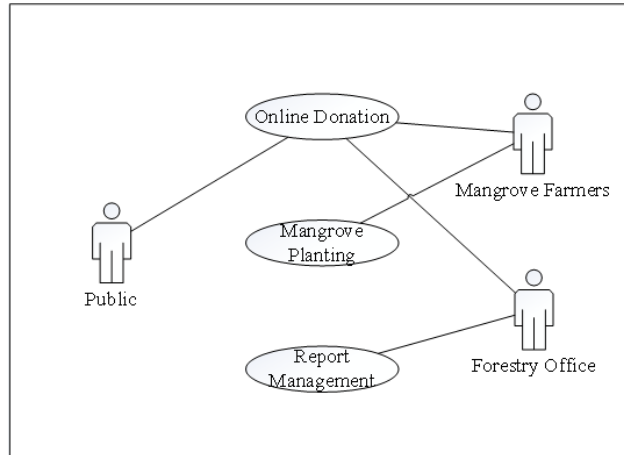
Figure 4. Use Case Proposed

3.3. Definition of Actor and Descriptions

The actors involved are the Forestry Service, Community, and Mangrove Farmers. These actors are directly involved in making online donations. For a more specific explanation, it is shown in Table 1.

Table 1. Definition of Actor and Descriptions

No	Actor	Description
1	Forestry Office	The division that manages mangrove distribution reports
2	Public	The part in charge of making online donations
3	Farmers	The division in charge of planting mangrove seedlings

3.4. Definition of Usecase dan Descriptions

The functions contained in the examination process that occur after the patient develops lung disease. This function is based on the procedure/system proposed at the Forestry Office. For a more specific explanation, it is shown in Table 2.

Table 2. Definition of Use Case and Descriptions

No	Use Case	Description
1	Online Donation	This process is the process of purchasing mangrove seedlings and will be donated to every area in West Java
2	Planting mangrove seeds	The process of planting mangrove seedlings that have been donated by the community by mangrove farmers
3	Mangrove Report Management	The process of data entry and reporting by the Forestry Service

3.5. Implementation

The implementation stage is the application of the system design that has been made, and the system is ready to be put and operated [9, 10].
a. Software
   The software used to implement the system is as follows:
   1. Web browser
   2. Operation System Windows XP.
b. Hardware
   1. Using a minimum Pentium processor 4.
   2. RAM at least 512 MB
   3. At least 250 GB hard drive.

3.6. Previous research

To complement the current research, some guidance is needed in developing the system that has been carried out by other studies so that researchers can now maximize the functions built specifically to make manforserv technology design (mangrove forest conservation) webGIS application forest mangrove.

Table 3. Previous Research

Name of Researcher	Function	Problems
Fathurrohmah, Septiana Bunga, Karina Marjuki, Bramantiyori Rahayu[2]	Produce a monitoring application for the distribution of mangrove forests	There is no direct community involvement regarding mangrove planting.
Wardani, Sistria Hijrah Rismawan, Tedy Bahri, Syamsul[3]	Produce applications in determining the application of mangrove plant species.	Only limited to one method, namely K-Nearest Neighbour (KNN).
Yuliasamaya Darmawan, Arief Hilmanto, Rudi[4]	Produce applications in determining mangrove distribution factors.	Analysis of the distribution of mangrove cover is not integrated with web GIS.

So with the previous research, it provides a need for applications that will be made for the community and the Forestry Service and mangrove farmers. From the application made, functions that have not been provided can be added so that mangrove damage can be reduced.

Based on the description of the running system, it can be concluded in Table 4.

Table 4. Evaluation

Problems	Pa	Proposed

o		rt	
There is no integrated recording system regarding reports of mangrove planting in various areas of West Java.	Fo restry Office		Create a menu of reports on the distribution of mangroves for each area in West Java.
Lack of public awareness and knowledge regarding preserving mangrove forests.	P ublic		Create an online donation menu to purchase mangrove seeds that will be donated.
Do not have a place for selling mangrove seeds that are managed by mangrove farmers	Fa rmers		Create a mangrove sales menu in an online donation application.

4. Conclusion

So, to help conserve forests, an application is needed to support forest conservation. As for the design in the form of online donations, planting seeds, and reporting. In building applications for forest conservation using the prototype development method. This is used to make it easier to obtain data and describe the application function according to user needs.

Acknowledgement

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