

# Tracking of Mangrove Forest in the Coastal of North Sulawesi based on Satellite Image to Support Mangrove Natural Tourism Objects

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## ABSTRACT

Technology that is increasingly developing and advanced can provide progress in various social, economic, and technological aspects. Currently, the relevant agencies such as the marine and forestry services, the environmental service, which still do not know the existence of mangrove forest in the North Sulawesi area and can also find out the extent of the damaged area in the mangrove forest. North Sulawesi province has 11,456 ha of mangrove forest spread over 13 cities and regencies with various conditions. Utilization of satellite imagery technologies or remote sensing is a solution for finding the location of mangrove forest and the area of mangrove debt damage in North Sulawesi that is not yet known using Landsat Mapbox image data. Therefore, the purpose of making this application is to facilitate the relevant agencies in finding the location of mangrove forests and knowing the extent of damage to the mangrove forest in North Sulawesi. The result of this study are able to display information on the location of mangrove forests and find out the area of mangrove damage that we are looking for in the webgis view. This application uses the NodeJs programming language. Js using the React Js user interface and the database used is PostgreSQL.

## General Terms

Webside, ReactJs, PostgreSQL

## Keywords

Information Systems, Mangrove Forest, Satellite Image

## 1. INTRODUCTION

Mangrove forest is one of the coastal resources that play an important role in development. Mangrove areas actually have a very important role for humans and animals that live in or around them. The mangrove ecosystem is a system consisting of organisms (plants and animals) that interact with environmental factors and with each other in a mangrove habitat [1]. The coastal area is a meeting area between land and sea, each of which is influenced by oceanic properties such as tides, sea breezes and salt water infiltration which is also a place for natural ecosystems such as mangrove forests, swamps and so on. Mangroves have an important role in coastal areas. one of which protects the coast from waves, wind and storms[2]. Mangrove stands can protect settlements, buildings and agriculture from strong winds or seawater intrusion. Mangrove forest is a unique forest ecosystem and acts as a connection between land and sea ecosystems. The ideal place for mangrove forests is around the coast, estuary, or delta with sediment in the form of sand or mud, sloping and relatively protected. 11,456 ha spread over 13 cities and regencies with varying conditions. . According to the

regulation of the minister of forestry no. P.03/MENHUT- V/ 2004, mangrove forests are forests that grow on alluvial soils in coastal areas and around river mouths that are influenced by tides and are characterized by tree species (Avicennia, Sonneratia, Rhizophora, Bruguiera, Luminitzera, Xylocarpus, and Nypa)[3]. One method that can be used in finding the location of mangrove forests and knowing the extent of damage to mangrove forests or tracking mangrove forests is by using remote sensing technology, especially Landsat mapbox image data. By using remote sensing data, areas that are difficult to access by residents although it can be detected actually and quite well without direct contact with the object or area[4].

## 2. METHODOLOGY

In this study, the method used is descriptive method to identify and describe field conditions and various complex and accurate information. Descriptive method is a method in examining the status of a group of people, an object, a set of conditions, a system of thought or an event in the present. The purpose of this descriptive research is to make a systematic, factual and accurate description, picture or painting of the facts, properties and relationships between the phenomena being investigated.

### 2.1 Method of Collecting Data

The method used is to collect satellite image data through landsat map box satellite imagery data. Literature study to find references that can be used as the basis of the study and theoretical basis that can support the data as a reference in conducting the research.

### 2.2 System Development Method

The system development method used is the waterfall method. The waterfall method is the work of a system carried out sequentially or linearly. The stages carried out using the waterfall method are as follows:

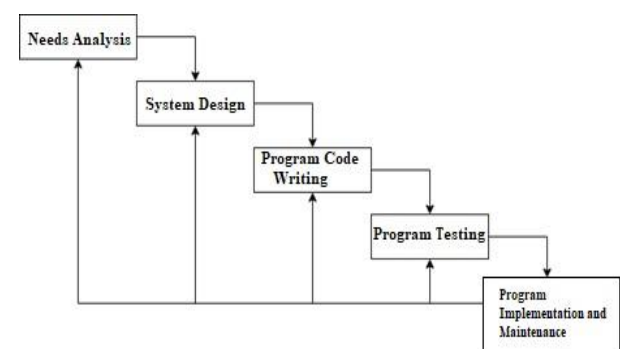


Fig 1:Waterfall Development Stage

## 2.3 System Planning

### 2.3.1 Use Case Diagram

Use case diagrams describe the behavior of the system behavior to be created. Use case diagrams describe an interaction between one or more actors and the system to be created. In simple terms, use case diagrams are used to understand what functions are in a system and who can use these functions.

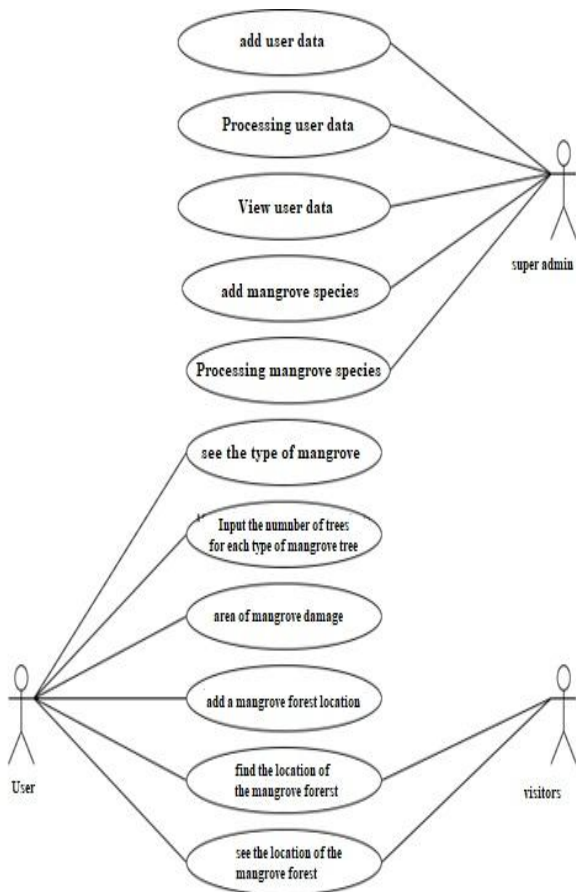


Fig 2:Use Case Diagram

### 2.3.1 Context Diagram

Context Diagram is a diagram that consists of a process and describes the scope of a system. Context diagram is the highest level of DFD which describes all inputs to the system or outputs from the system.

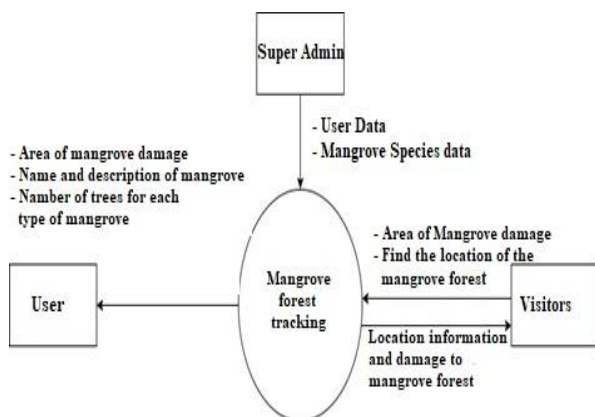


Fig 3:Context Diagram

## 2.4 System Testing

The system testing method in this research is Black-box testing. The purpose of this test is to test all the elements of the software that are made whether they are in accordance with what is expected or otherwise. This test will ensure that the input and response received are the same so that there is a match between the application and admin, users, and visitors.

## 3. RESULT AND DISCUSSION

In this section, the results of system testing will be shown in stages starting from the initial display, admin login, add user menu, add mangrove type menu, add mangrove forest location menu, mangrove forest location mapping, menu add population of each type of mangrove forest, wide view menu, mangrove damage area.

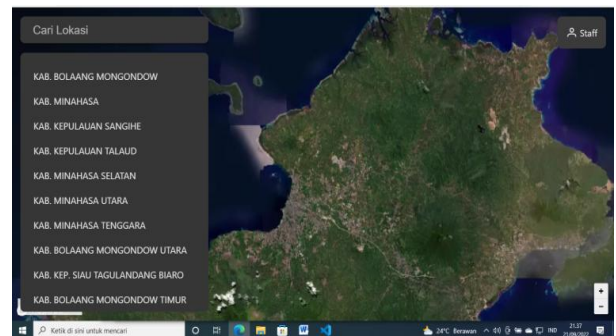


Fig 4:Initial View

### 3.1 Add User Menu

In Fig 5: the Add User View serves to add users, edit users, and delete users.

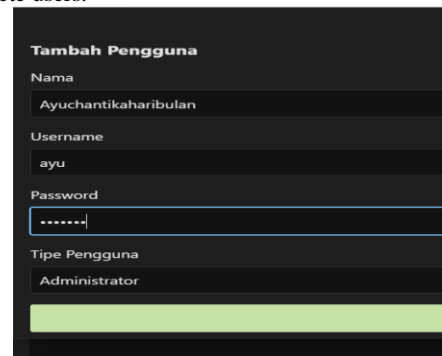


Fig 5:Initial View

### 3.2 Menu Add Types of Mangrove

Fig 6: shows the menu for adding Mangrove Types. Display functions to add edit, edit, and delete types of each type of mangrove.

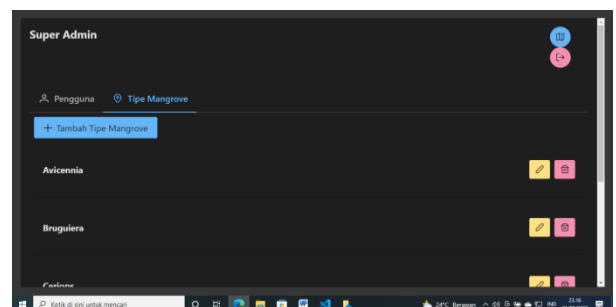


Fig 6: Display adds mangrove types

### 3.3 Adds Mangrove Forest Location

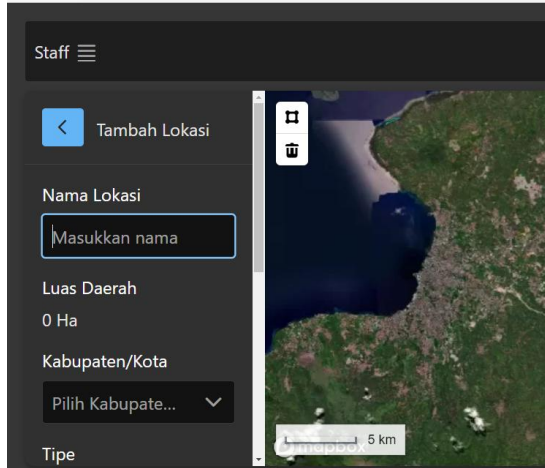


Fig 7: Display adds mangrove location

In Fig 7: the Menu Adds the Location of the Mangrove Forest serves to add the location of the mangrove forest

### 3.4 Mapping Mangrove Forest Location

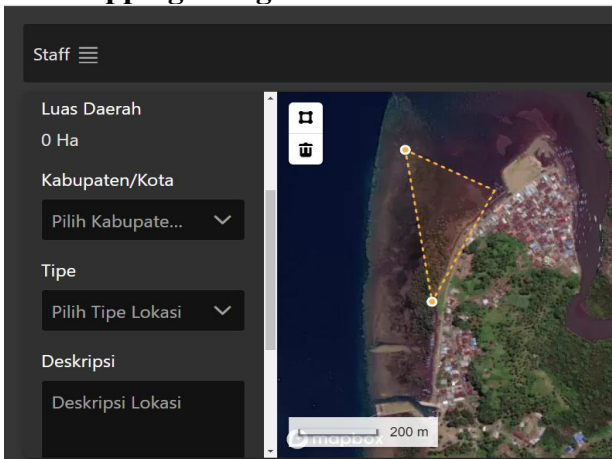


Fig 8: Display mapping mangrove forest location

In Fig 8: the mapping of the location of the distribution of mangrove forests above shows

### 3.5 Adding Mangrove Forest Type Tree Population

In Fig 9. Adding Tree Populations for each type of Mangrove Forest, the display serves to input the number of tree populations for each type of mangrove.

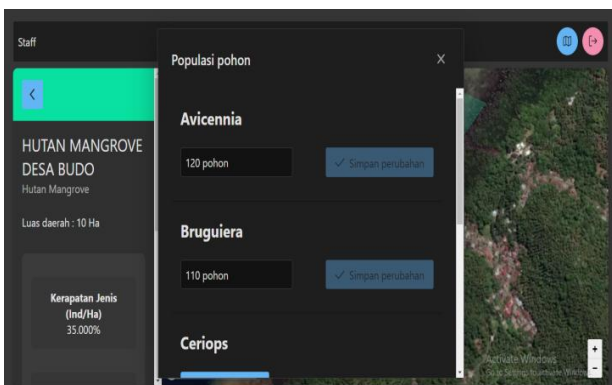


Fig 9: Display adds mangrove forest type tree population

### 3.6 Wide View of Mangrove Damage Area

Fig 10. Displays the Area of Mangrove Damage, showing the total area damage and the amount of damage that exists in mangrove forests.

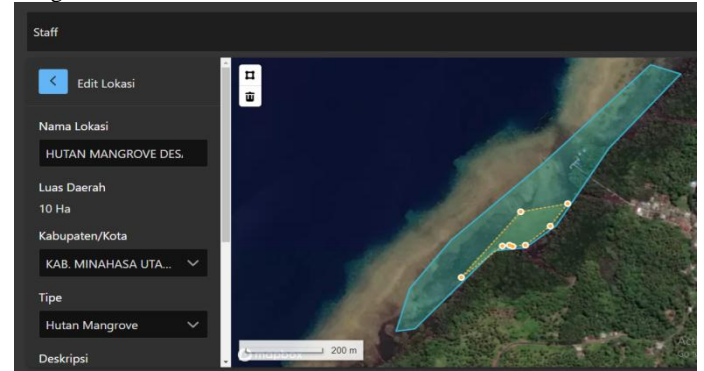


Fig 10: Display adds mangrove forest type tree population

Fig 10. Displays the Area of Mangrove Damage, showing the total area damage and the amount of damage that exists in mangrove forests.

### 3.7 Mangrove Density and Damage Test

Table 1. Mangrove Density Test

Name of mangrove forest	Density Type (Ind/ha)	Relative Density (%)	Test Monitoring
Binebas Village mangrove forest	95.000%	31.667%	Succeed
Mangrove Park Bahowo	16.154%	5.385%	Succeed
Trans Patoa Mangrove Tourism	34.400%	6.680%	Succeed
Dudepo mangrove forest	30.000%	15.000%	Succeed
Budo Village mangrove forest	35.000%	11.667%	Succeed

Table 2. Mangrove Density Test

Name of mangrove forest	Damage (%)	Test Monitoring
Binebas Village mangrove forest	0,73787%	Succeed
Mangrove Park Bahowo	0,8324%	Succeed
Trans Patoa Mangrove Tourism	0,259%	Succeed
Dudepo mangrove forest	1.045%	Succeed
Budo Village mangrove forest	0,5667%	Succeed

#### 4. CONCLUSIONS

From the results of testing the system with the mangrove forest tracking application, there are 5 test locations, namely the village of Binebase with a species density of 95% and a relative density of 31.667% while the damage is 0.73%. For mangrove debt in the tourist location of Budo village, the species density was detected at 35.00%, the relative density was 11.66%, while the mangrove damage was 0.566%. From the test results, it was stated that the mangrove forests in the distribution of the beach with a sample of 5 locations were still in a well maintained condition. Application test results provide information in the form of mangrove forest location points, location name, area area, relative density, and mangrove species as well as knowing the existence of mangrove forest damage and a description of the mangrove forest.

#### 5. ACKNOWLEDGMENTS

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