Web-Based Geographic Information System Application for Mangrove Planting Planning in Pari City Village

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ABSTRACT

Kota Pari Village has a strategic coastal area but faces the challenge of degradation of mangrove ecosystems. Kota pari Village has the potential for mangrove forests that can be used as tourist attractions in coastal areas. This research aims to design a Geographic Information System (GIS) to support appropriate and sustainable mangrove planting planning. The research method uses a quantitative descriptive approach with data collection techniques through field observation, interviews, and spatial analysis. The research stages include collecting geographic data, mapping ecosystem conditions, analyzing land characteristics, and identifying potential zones for mangrove planting. The Geographic Information System is developed using Web-based software by considering parameters such as topography, soil type, salinity, and abrasion rate. The results of the study show that GIS has successfully identified 15 potential zones for mangrove planting with different levels of land suitability. This system is able to provide recommendations for planting locations, appropriate types of mangroves, and appropriate conservation strategies. This research makes a significant contribution to supporting mangrove ecosystem restoration efforts, sustainable development planning, and coastal area management in Kota Pari Village.

Keyword : Geographic Information System: Mangroves; Pari City Village

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1. INTRODUCTION

Kota Pari Village is one of the coastal areas that has unique and strategic mangrove ecosystem characteristics (Akbar et al., 2022). However, the region faces serious challenges related to environmental degradation and the threat of damage to coastal ecosystems (Sumartono et al., 2022). If mangrove ecosistism is damaged, there will be a lot of losses (Wahyuni et al., 2022). The destruction of mangrove ecosystems occurs due to various factors, including climate change, human activities, and limited knowledge in sustainable management of natural resources (Hermansyah et al., 2024; Supiyandi et al., 2024; Wahyuni et al., 2024a, 2024b).

Mangrove ecosystems have a crucial role in maintaining the balance of the coastal environment. Mangroves function as coastline protectors from abrasion and erosion, Habitats for various species of marine life, Carbon sinks and climate change mitigation, Buffer zones between terrestrial and marine ecosystems and many other mangrove functions (Hasanah et al., 2022).

The need to develop a geographic information system application to plan mangrove planting in Kota Pari Village. Kota Pari Village is one of the coastal villages that has a mangrove ecosystem that has the potential to be developed (Irwan et al., 2021). However, the management is not optimal due to limited information and data related to coastal areas and existing land use (Saptari et al., 2021).

Good management of mangrove forests is important to preserve the coastal environment (Utomo et al., 2017). Previous research shows that mangrove ecosystems have very important ecological, physical, and economic functions (Kamal & Haris, 2014). Mangrove forests can increase aquatic fertility through littering, prevent soil acidity, and become a habitat for a variety of aquatic biota, such as fish,

shrimp, crabs, and shellfish (Kamal & Haris, 2014). In addition, mangroves can also prevent coastal abrasion and strengthen the coastline (Utomo et al., 2017).

Therefore, this study aims to develop a web-based geographic information system application that can support mangrove planting planning in Kota Pari Village (Wahyuni et al., 2022). With this application, it is hoped that it can help the village government and local communities in managing and planning mangrove planting activities optimally (Wahyuni et al., 2020).

2. RESEARCH METHOD

The research approach used in this study is a quantitative approach by applying the Waterfal system design method in designing and building the (Hermansyah et al., 2024). Research and Development (R&D) used to develop Geographic Information Systems by conducting application tests (Wahyuni, 2018; Wahyuni & Mesra, 2022; Wahyuni & Wadly, 2023). The use of the Descriptive method is used to describe the system that is designed and built according to the needs of the Kota pari village community and answers all the problems faced. In addition, this research also involves the village apparatus of Kota pari and mangrove volunteer activists who will use the application (Supiyandi et al., 2023, 2024; Supiyandi & Zen, 2019). This research also involves verification with experts, which can provide validation of the results of the analysis of mangrove planting planning and mapping.

Fig 1. Geographic Information System Components

This research is carried out step by step, starting from the identification of problems in the city of pari, especially problems related to mangrove conservation, after the problem can be identified, then a problem analysis is carried out to find out the formulation of the problem to be able to determine the existing goals with the methods carried out. The research team then determined the objectives and objectives of the study. Data collection is carried out to obtain data in the field and can be input and input for designing application programs according to the needs of the community based on the analysis of the situation in the field. After the data is obtained, planning is carried out in a structured and appropriate manner to get appropriate results. After the plan is carried out, the application that has been designed, implemented to the community of the pari city village in accordance with the initial plan, while adjusting and evaluating the program if there are obstacles in the field. After implementation, the accuracy level and error testing was carried out on the Geographic Information system for mangrove planting planning. After all stages are carried out and the final stage of implementation and testing is carried out, namely the results of this research. The following are the working steps of the existing research method. As shown in picture 2 below :
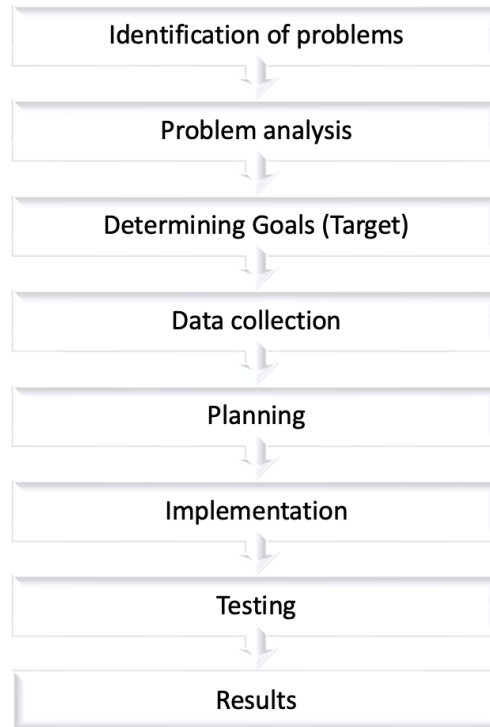
Fig 2. Research Stages

3. RESULTS

The program can be run on a website-based system with *a web browser* to enter the main page of the Geographic Information System for planning mangrove planting in the village of Kota Pari based on the Website:

A. *Main Menu Interface Display*

The main page is the main page when accessing the *address bar*, from the main page and there are menus that can be accessed when accessing the web-based livestock sales application as follows:
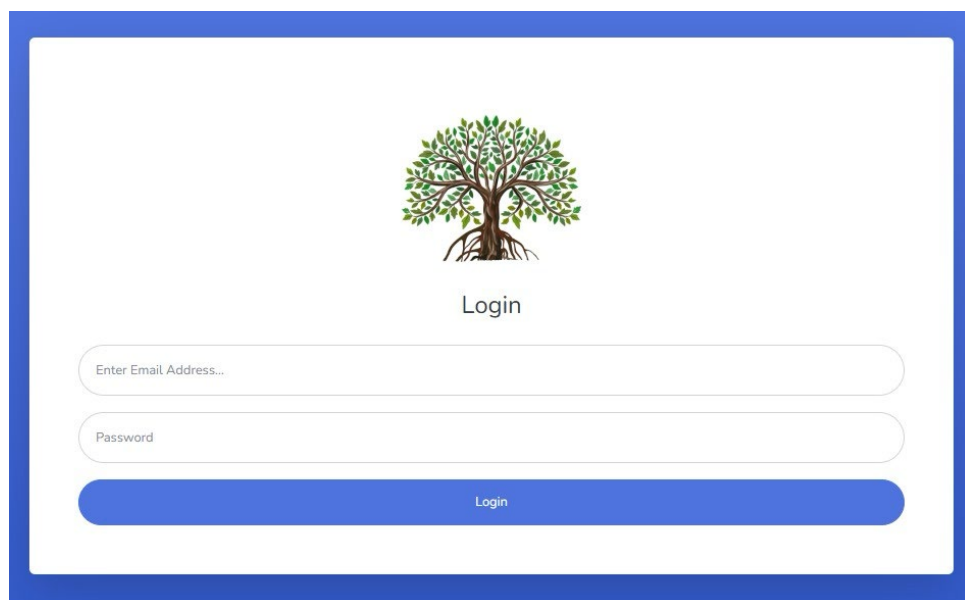

Fig 3. Home Menu

B. *Login Page*

The Login Page is the first page before we enter the main page. Where we have to input the username and password to be able to enter the main page of the main geographic information system for planning mangrove planting in the village of Kota Pari based on the Website as follows :
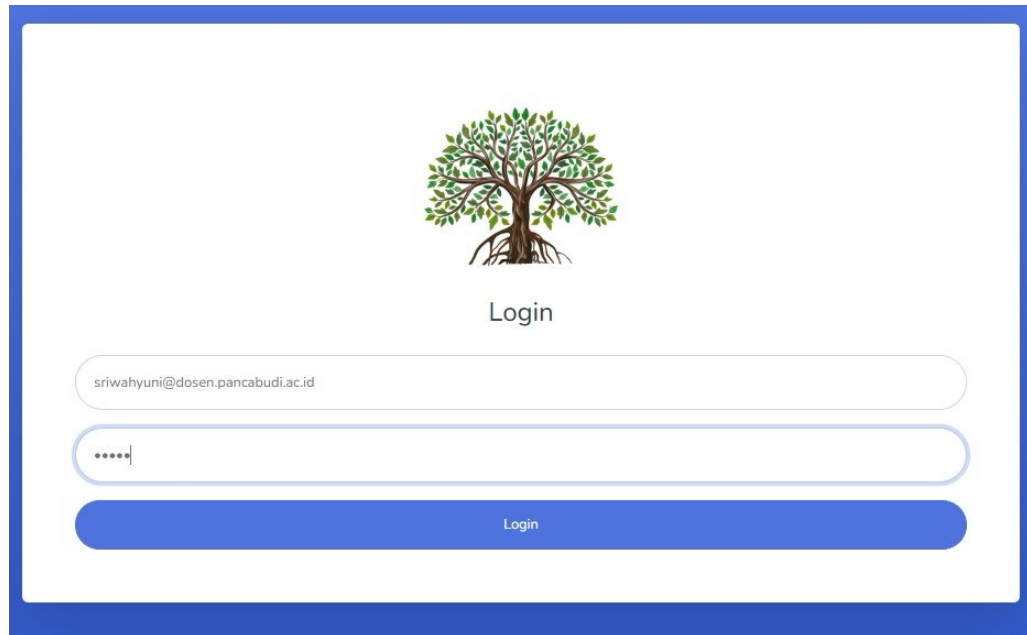

Fig 4. Login Page

C. Mangrove Mapping Page
On the mangrove mapping page, users can select various layers available on the left side of the screen. This layer includes:
1. Topography: Displays the contours and elevations of the area which helps in understanding the geography of the location.
2. Salinity: Indicating the level of salinity at various points, it is important to determine the most suitable mangrove species.
3. Current Pattern: Provides information about currents and their potential influence on the sustainability of mangrove planting.
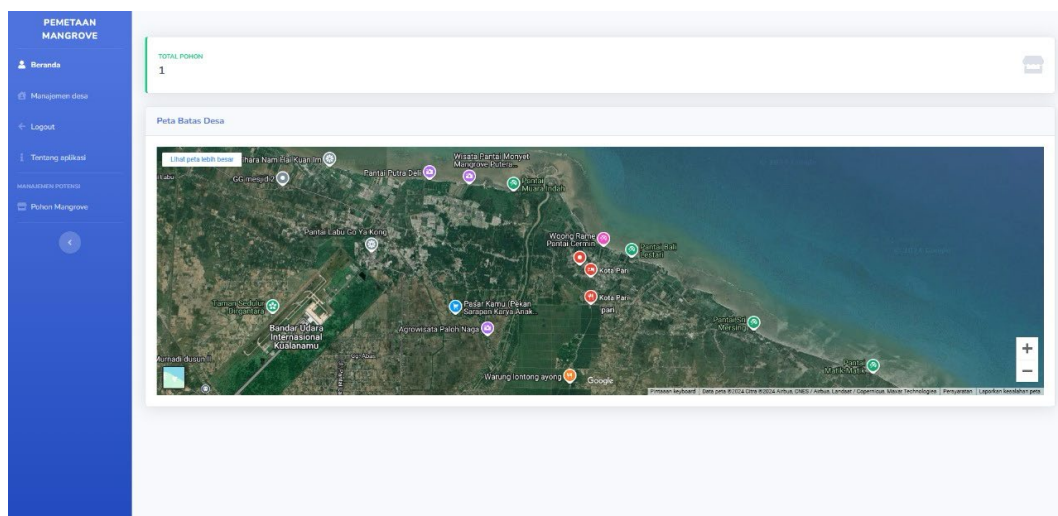

Fig 5. Mangrove Mapping Page

D. Village Management Page

On the Village management page, there is a feature that can be used to plan a mangrove planting program, by inputting data on village management as follows:
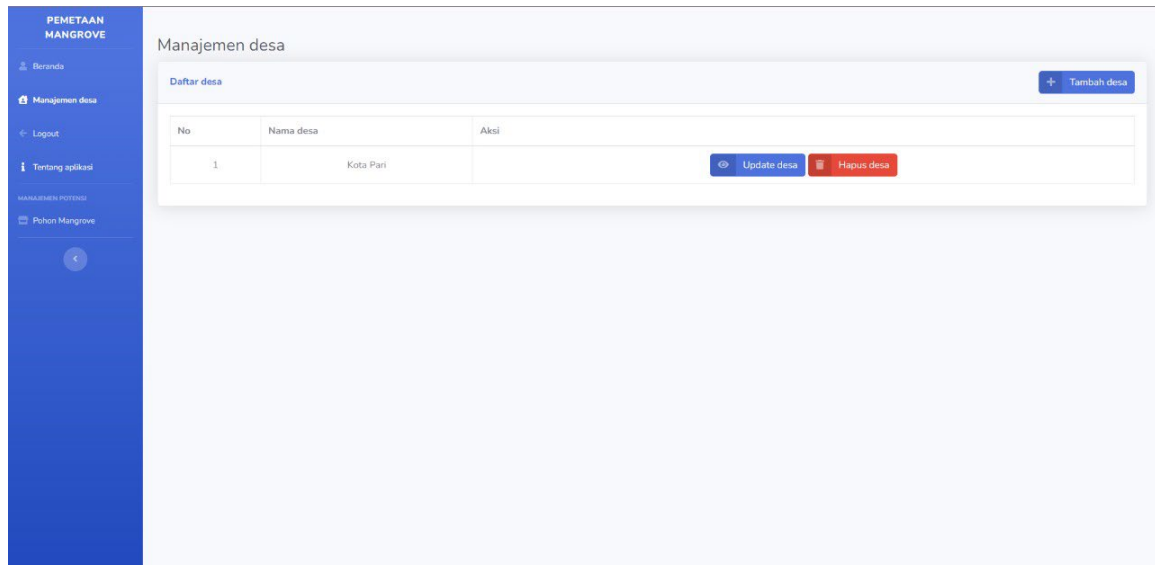

Fig 6. Village Management Page

E. Village Input
On the village input page, there is a feature that can add villages or mangrove management distribution areas that can be expanded to mangrove conservation areas in accordance with the program carried out as follows:
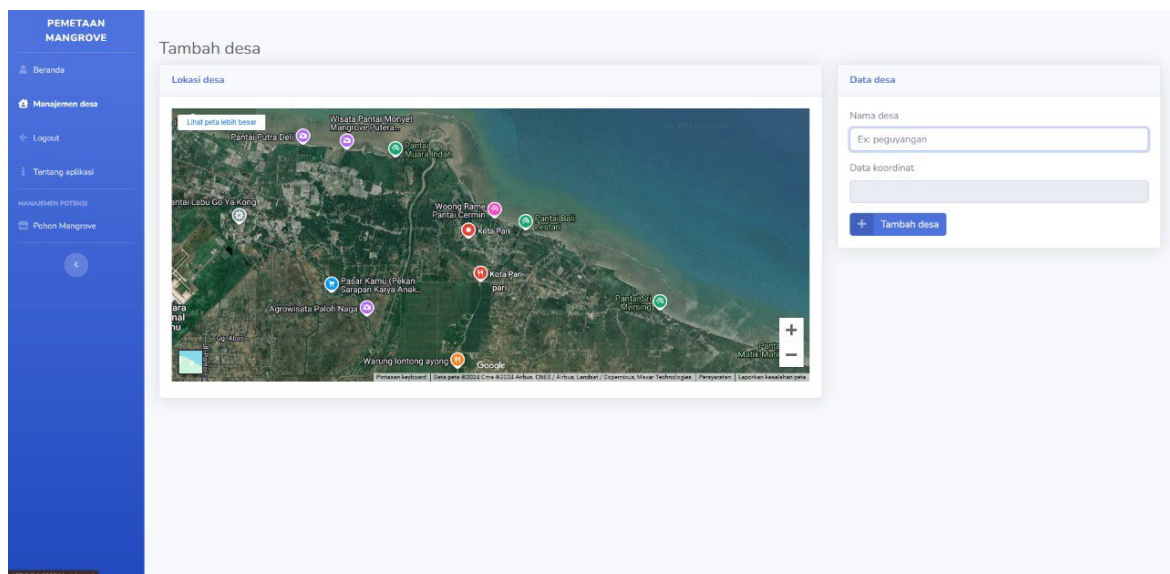

Fig 7. Village Input Page

F. Mangrove Tree Data Input
On the Mangrove Tree Data Input page, there is a feature that can be used to input data on planted mangrove trees and the distribution of planned planting areas in the application as follows:
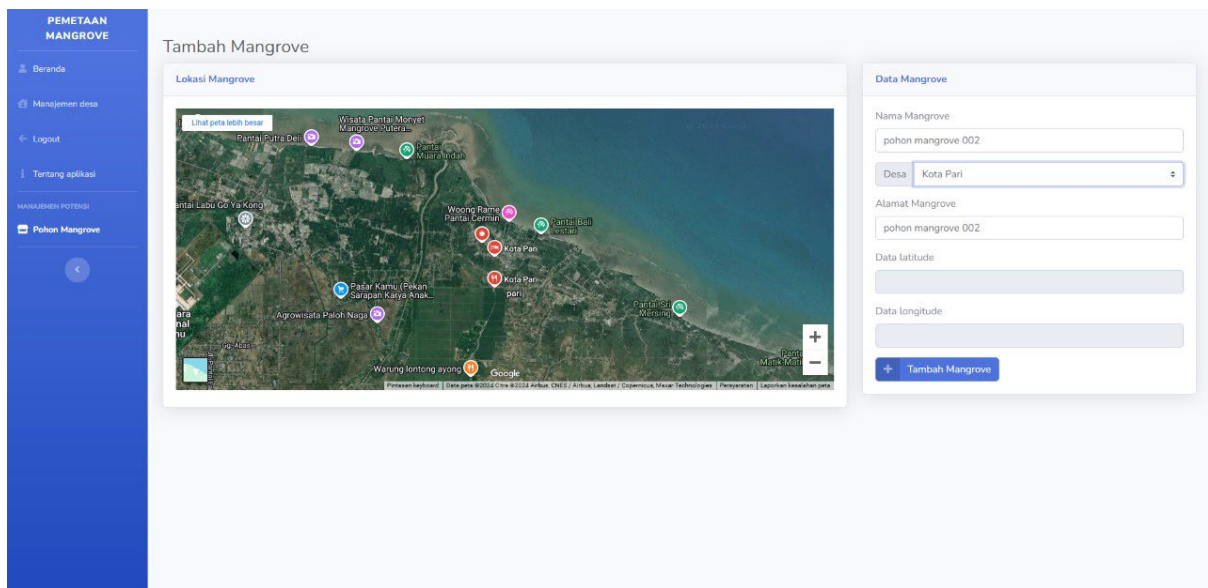
Fig 8. Mongrove Tree Data Input Page

G. Mangrove Tree Management Page

On the Mangrove Tree page, there is a mangrove tree data feature and its distribution area and can be used to input data on planted mangrove trees and the distribution of planned planting areas in the application as follows:
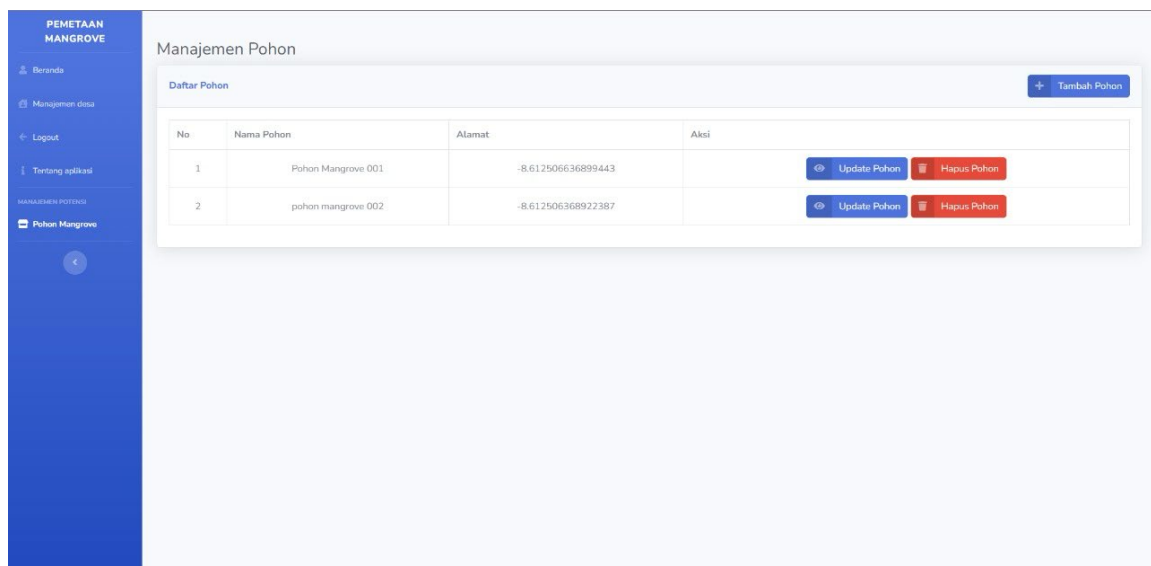

Figure 9. Mangrove Tree Management Page

H. Mangrove Tree Data Delete Page

On the delete mangrove tree page, there is a feature that can be used to delete mangrove tree data and distribution areas if there is a change in the mangrove tree planning program or if the mangrove tree in a certain area dies or is damaged as follows:
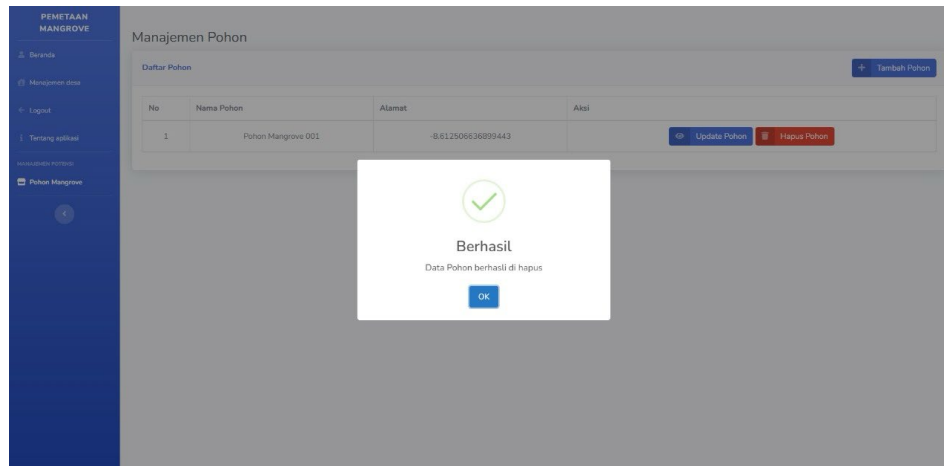
Fig 10. Mangrove Tree Delete Page

4. CONCLUSION

Conclusion of the study:
1. This study confirms that the application of Geographic Information System (GIS) in mangrove planting planning in Kota Pari Village is very effective and useful. Some of the key points from the results of the study are as follows:
2. Potential Site Identification: GIS allows the identification of strategic locations for mangrove planting based on analysis of environmental data, such as salinity, water depth, and accessibility. This ensures that planting is carried out in the areas that most support the growth of mangroves.
3. In-Depth Spatial Analysis: The use of spatial analysis provides better insights into geographical and environmental characteristics, which helps in data-driven decision-making.
4. Community Participation: The people of Kota Pari Village show high interest and support for the mangrove planting program. Their involvement in the planning and implementation process is the key to the success of this program.
5. Increased Environmental Awareness: This program not only focuses on planting, but also raises public awareness about the importance of mangroves in protecting the environment and mitigating climate change.

Suggestions for future Research may note the following:
1. Implementation of Planting Plan: Immediately implement the mangrove planting plan in locations that have been identified as potential. Involving the community in this process will increase their sense of ownership and responsibility for the success of the program.
2. Training and Education Program: Hold a training program for the community related to mangrove planting and maintenance techniques. Education about the benefits of mangroves for ecosystems and daily life is also very important to increase awareness and participation.
3. Monitoring and Evaluation: Create an effective monitoring and evaluation system to monitor mangrove growth and its impact on the environment and local economy. This data can be used to compile periodic reports and future program improvements.
4. Partnership Development: Establish partnerships with government agencies, non-governmental organizations, and academics for technical support and resources. This cooperation can strengthen the implementation of the program and expand the range of benefits.
5. Sustainable Use of GIS Technology: Continue the use of GIS technology for advanced monitoring and planning. Training for local stakeholders in using GIS will help in the sustainable management of natural resources.
6. Environmental Awareness Campaign: Conduct a campaign to raise public awareness about the importance of mangroves in maintaining ecosystem balance and mitigating climate change. Activities such as seminars, workshops, and community activities can be an effective tool.

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