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Innovation Of The Sipemang Application Using Qr Code For Monitoring And Preserving Mangrove Ecosystems In Pari City Village

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ABSTRACT

Mangrove ecosystems have an important role in maintaining the balance of the coastal environment. However, its existence is increasingly threatened by human activities and climate change. Effective monitoring and preservation of mangrove ecosystems is crucial. Kota Pari Village, with its mangrove potential, needs an innovative system to support these efforts. Therefore, this study aims to develop a QR Code-based Mangrove Monitoring Information System application "SIPEMANG". This application is designed to facilitate monitoring mangrove conditions, collecting data on mangrove species, and involving the community in mangrove conservation. Community involvement is not only the community around the village of Pari City but through the application can reach community involvement around the world. QR Codes placed on each mangrove tree allow quick access to specific information about the mangrove tree. The data collected through the application will be processed and analyzed to provide the latest information about the condition of the mangrove ecosystem in Kota Pari Village. So in addition to mangrove planters, the next important thing is to ensure that mangroves grow and develop properly. It is hoped that the SIPEMANG application can be an innovative solution in supporting the monitoring and preservation of mangrove ecosystems in a sustainable manner.

Keyword : Sipemang; Application; Mangrove; QR Code

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1. INTRODUCTION

Mangrove ecosystems are essential coastal habitats that provide numerous ecological and economic benefits (Kopetz & Steiner, 2022; Mouha, 2021). They act as natural "sponges" to absorb pollutants, support diverse marine life, and offer livelihood opportunities for local communities (Pringgenies et al., 2021)(Hasanah et al., 2022a, 2022b). However, the mangrove ecosystem in the South Coast of Pamekasan, Madura Island, has been facing significant challenges, including overexploitation and environmental degradation. (Islamy & Hasan, 2020) To address these issues, it is crucial to develop innovative solutions that can effectively monitor and preserve the mangrove ecosystem. In addition to the environmental benefits of planting and preserving mangroves, there is a potential that is no less important, namely if handled very well and innovatively, it will become a potential tourist area that can bring in income for the community in Kota Pari Village. Damage to coastal conditions in the village area of Pari city due to the destruction of mangrove areas can cause various losses (Nababan & Sitompul, 2018a, 2018b; Sitompul & Nababan, 2018). The mangrove ecosystem in Kota Pari Village has faced increasing threats in recent years, including illegal logging, conversion of land for agricultural and residential purposes, and pollution from nearby industrial activities. These environmental pressures have led to a significant decline in the mangrove cover, which has threatened the delicate balance of the coastal ecosystem and the livelihoods of the local community. To address these pressing issues, it is crucial to develop innovative solutions that can effectively monitor and preserve the mangrove ecosystem in the region. There have been many previous studies that have shown success by using internet innovation and technology (Hariyanto et al., 2019; Marlina et al., 2023; Pratama et al., 2023; Wahyuni, Hermansyah, et al., 2022; Wahyuni & Mesra, 2022; Wahyuni & Wadly, 2023)

In addition, the community must also increase their awareness through increasing understanding and knowledge (Lubis et al., 2022; Sebayang et al., 2021; Wahyuni, Hariyanto, et al., 2022). The objective of this research is to design and implement an innovative SIPEMANG application that utilizes QR code technology to enhance the monitoring and conservation of the mangrove ecosystem in Kota Pari Village.

Fig. 1: Mangrove Area in Kota Pari Village.

2. RESEARCH METHOD

A. Research Approach

This research uses a scientific research approach, namely an approach based on science and technology. The approach method used can be seen in figure 2. as follows:

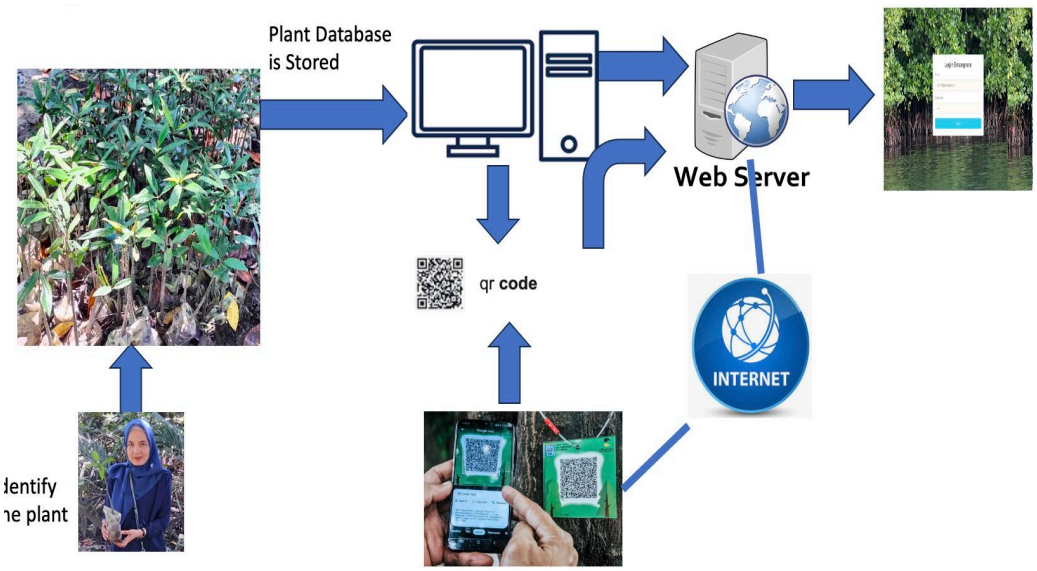

Fig 2. Research Methods

B. Research Framework

The research framework carried out is as follows:

Fig 3. Research Framework

This research uses a Research and Development (R&D) approach that is adapted to the latest technological developments. The stages of the research are:

1. Literature Study and System Requirements Analysis.
   a. Conduct a comprehensive literature review on best practices for mangrove monitoring using digital technology.
   b. Identify the needs of users and stakeholders related to an efficient and easy-to-use mangrove monitoring system.
2. SIPEMANG Application Architecture Design.
   a. Design a modular and scalable application architecture to ensure flexible development in the future.
   b. Adopt the latest material design concepts and user experience principles to create an intuitive interface.
3. Flutter Framework-Based Prototype Development.
   a. Choosing the Flutter framework as the development basis to ensure cross-platform compatibility (Android, iOS, Web).
   b. Leverage the latest libraries and tools in the Flutter ecosystem to deliver cutting-edge features.
4. QR Code Implementation for Mangrove Identification.
   a. Designing a unique QR Code labeling system for each individual mangrove tree.
   b. Integrating QR Code scanning technology with the SIPEMANG application for easy identification and tracking.
5. Testing and Validation of Application Functions.
   a. Conducting a series of tests, both unit testing, integration testing, and user acceptance testing
   b. Ensure all features run as expected and meet mangrove monitoring needs.
6. Evaluation of Adoption Rate and Impact in Society.

a. Measuring the acceptance and adoption rate of the SIPEMANG application by the people of Kota Pari Village.

b. Assessing the impact of the use of the application on increasing public participation and awareness in mangrove conservation.

3. RESULTS AND DISCUSSION

The implementation of the Sipemang application program, a website-based planting information system and mangrove monitoring system, is carried out with a system procedure that has been completed using the waterfall method in the Website-based City Village and system testing is carried out in the mangrove area on Mydarling Beach in Pari City Village.

A. Program View

Running the system for *a web browser* in this test, the author uses *the Google Chrome web browser* and After the *web browser* runs, type in the *address bar* http://emangrove.my.id/home to enter the main page of the Mangrove planting and monitoring application in Dedsa Kota Pari based on the Website:

1. Home
   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:
   a. Total Mangroves Planted
   b. Total Mangrove Volunteers
   c. Mangrove Type Information
   d. Mangrove Status Information

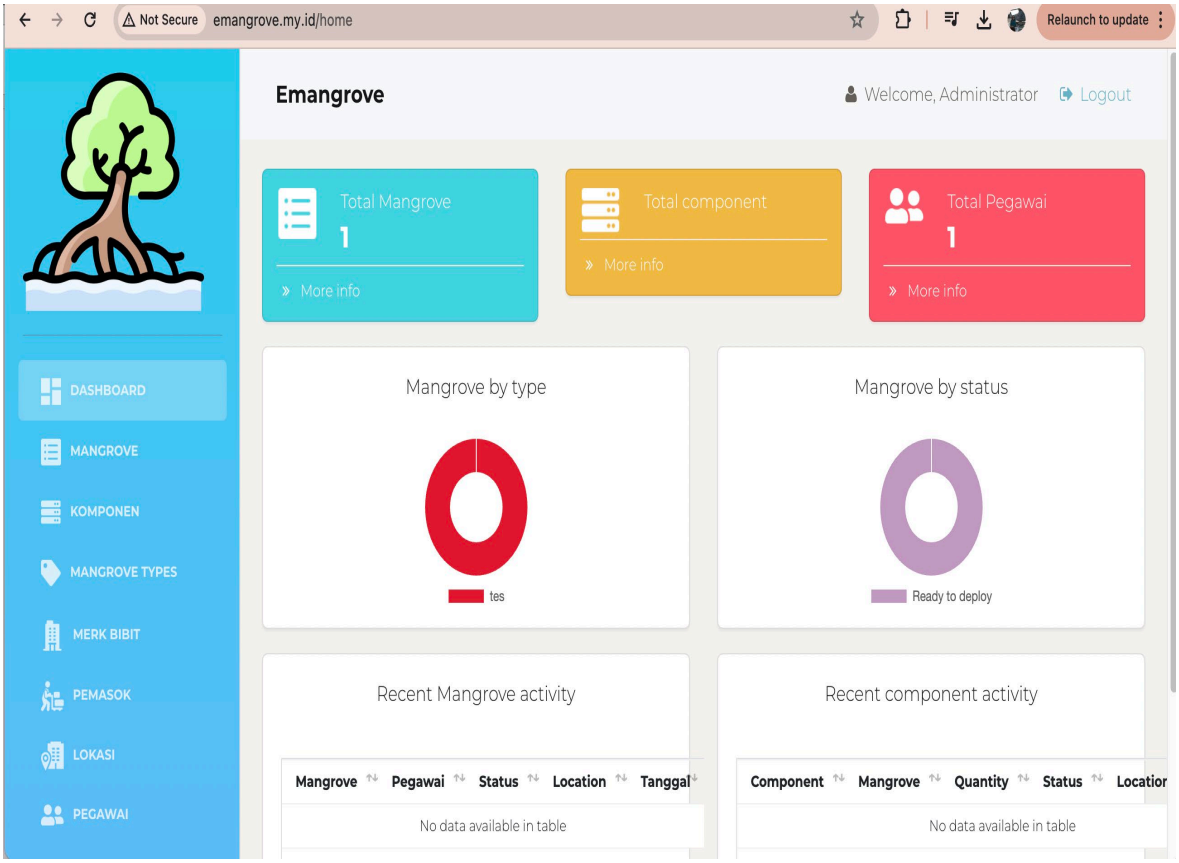

Figure 4. Main menu display

2. Menu Mangrove

The mangrove menu is a page that displays a list of planted mangroves equipped with images and mangrove barcode codes.

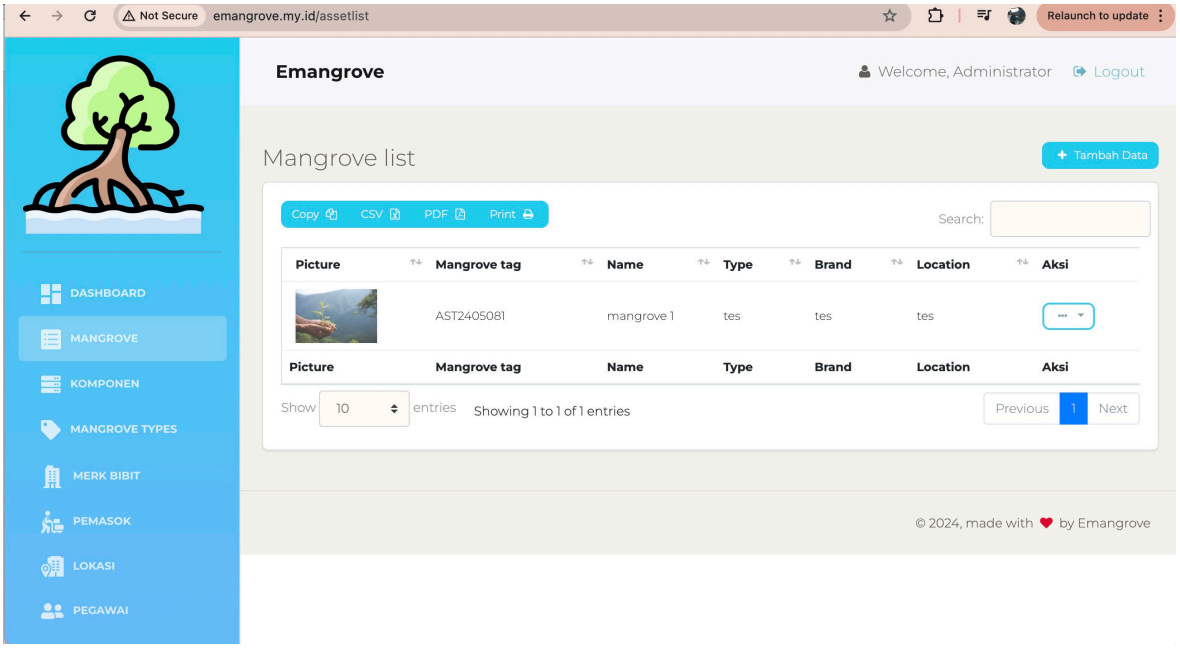

Figure 5. Mangrove List menu display

3. Menu Mangrove Types

The menu that displays Types can be information on the type of way to plant mengrove so that it is easier to get data and information.

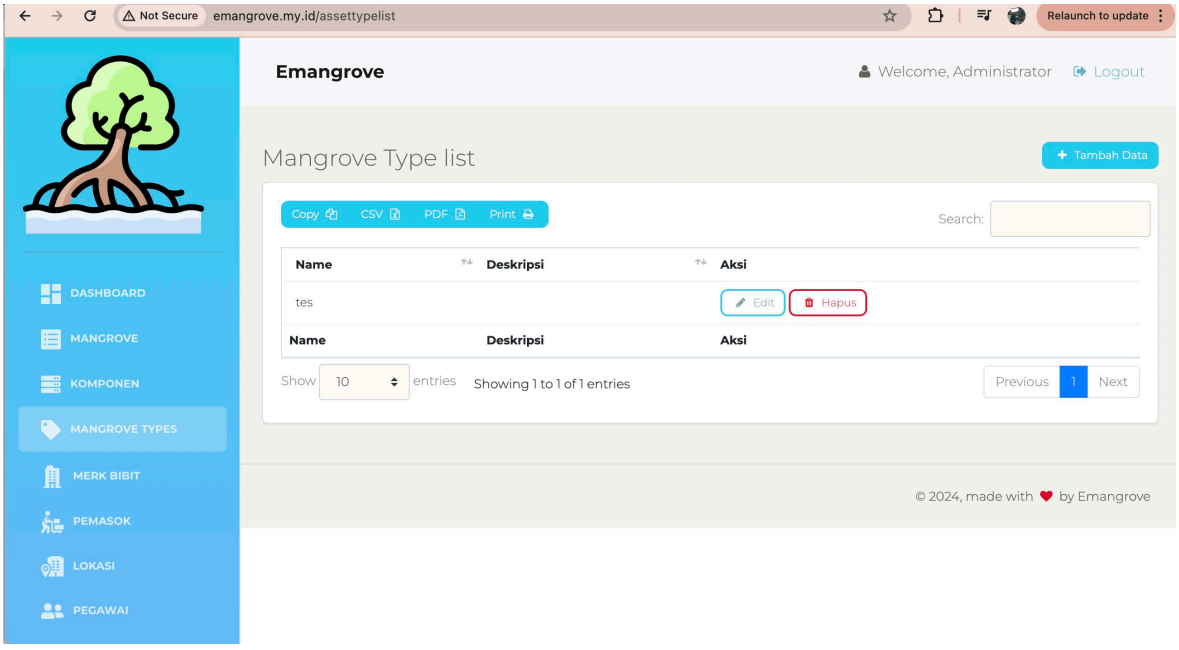

Fig 8. Buyer Page View

4. Location List Menu
   This menu provides access to an interactive map that displays mangrove planting locations. Users can see the mangrove planting points that have been carried out, as well as find out more information about each location.

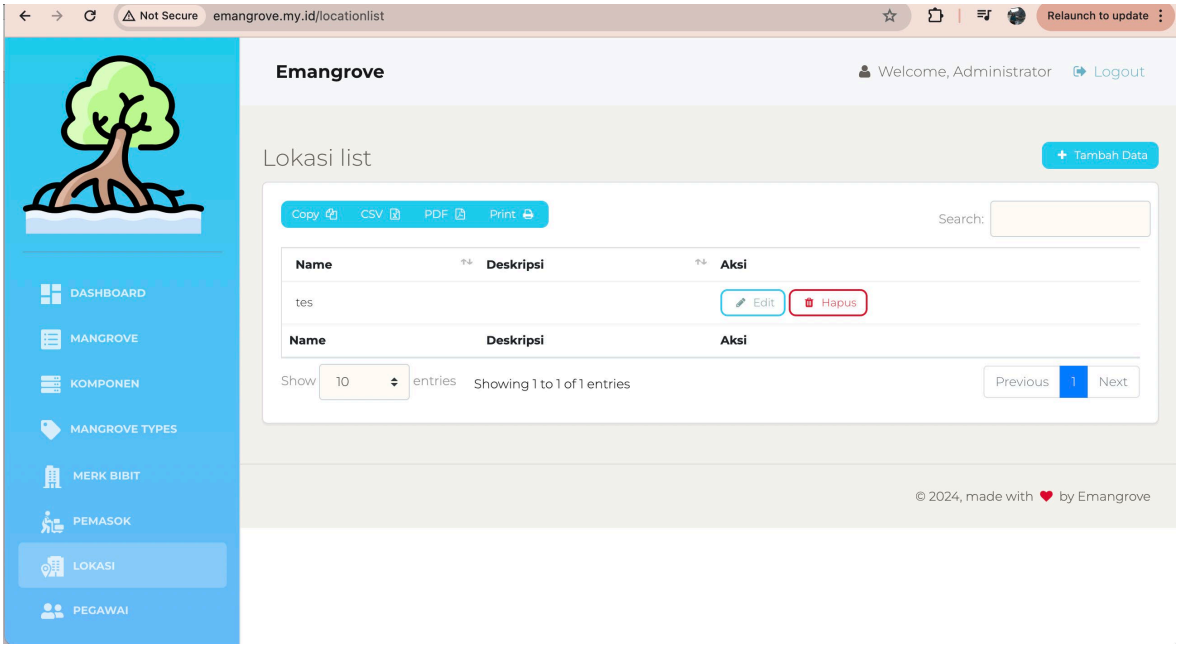

Figure 9. Location Menu Display

B. Discussion of Program Implementation in Kota Pari Village

The implementation of the mangrove planting and monitoring application program is carried out in one of the mangrove areas in Kota Pari Village that really needs the attention and concern of the community in mangrove planting, namely on Kurnia MyDarling beach, Kota Pari Village. This program also collaborates with the Indonesian Navy in terms of providing an overview of mangrove areas and providing information on important location points for mangrove planting. In addition, the implementation of the program is also in collaboration with mangrove conservation volunteers and the Pari City Village office represented by Mr. Hambali as the Secretary of Pari City Village. Along with the community in Pari City Village. All those involved showed high enthusiasm for this program. This meeting began with an explanation of the purpose and benefits of mangrove planting and monitoring applications. The application application is a tool that will facilitate the process of planting and monitoring mangroves in the coastal area of Kota Pari Village. Through this application, the community can actively participate in mangrove conservation programs and see the development of coastal ecosystems in real-time. The pilot program directly involves the village community in the use of the application.

After analyzing the situation, Kurnia Mydarling Beach was determined as a trial and implementation of the application program, the team went directly to Kurnia Mydarling Beach several times to see the conditions and locations where mangroves will be planted. The mangrove planting and monitoring application is also equipped with a growth monitoring feature. The community will be encouraged to routinely enter data such as tree height, growth conditions, and the development of the surrounding ecosystem. This data will provide important information about mangrove health and help in evaluating the success of the program. The research team provides technical support and assistance for users of the application. The public can contact the research team through the help and support features integrated in the application to get solutions to the obstacles or questions they face. With this application, every individual has an important role in maintaining coastal ecosystems and protecting mangroves. The application can also be an innovation in inviting the community to share knowledge, experiences, and photos with each other through the community features in the application, so that a

strong network is established in mangrove conservation efforts. This application also answers the needs of the younger generation in loving mangroves and in accordance with industry 5.0. So that it can create a generation of mangrove love.

4. CONCLUSION

Based on the results of the research of the Sipemang Application, Mangrove Planting and Monitoring Information System to Maintain the Sustainability of Mangrove Forests in Kota Pari Village Based on the Website in Increasing Livestock Sales in Kota Pari Village, the following conclusions can be drawn:

1. The Website-Based Mangrove Planting and Monitoring Application to Maintain the Sustainability of Mangrove Forests in Kota Pari Village has been successfully applied to the Mangrove Conservation Group in Kota Pari village with a trial of mangrove planting at Kurnia My Darling Beach, Kota Pari Village.
2. The Website-Based Mangrove Planting and Monitoring Application to Maintain the Sustainability of Mangrove Forests in Kota Pari Village can help conservation in getting support and branding for planting mangroves around the world because the application can be accessed anywhere with an internet connection.
3. The results of this study show that mangrove planting and monitoring applications can help maintain the sustainability of mangrove forests in Kota Pari Village. With this app, locals and volunteers can get involved in mangrove planting and maintenance efforts in an organized manner. The information documented in the application can also be used for evaluation and planning of future mangrove conservation activities.
4. The mangrove planting and monitoring application developed has features that allow users to register and get information about mangrove planting programs. The monitoring feature allows users to monitor the growth and condition of the mangroves that have been planted. The application also provides a report feature that allows users to report on the growth, state of mangroves, as well as upload photos as visual notes.

From the research that has been carried out on the Mangrove Planting and Monitoring Application to Maintain the Sustainability of Mangrove Forests in Kota Pari Village Based on the Website, there are several suggestions that hopefully this research can be developed by the next researcher as follows:

1. The Mangrove Planting and Monitoring Application to Maintain the Sustainability of Mangrove Forests in Kota Pari Village Based on this Website can be developed based on Android so that it can make it easier to monitor using an android smartphone.
2. The Application for Mangrove Planting and Monitoring to Maintain the Sustainability of Mangrove Forests in Kota Pari Village Based on the Website in the future will be evaluated over a longer period of time and involve more users.
3. The research can focus on developing additional features such as mapping mangrove planting locations or integrating with sensor technology to monitor environmental conditions in real-time.

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