Development of the Mersing Tourism Operator System for Diver Management in Mersing, Johor, Malaysia

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Abstract. The Mersing Tourism Operator System (MeTOS) is a comprehensive software solution developed to facilitate the efficient management of divers visiting the picturesque island of Mersing in Johor, Malaysia. Currently, all actions are recorded manually by hand in a book. Because humans make mistakes, this approach is very subjective and inconsistent. Based on the circumstance, a MeTOS was created. This research article presents an in-depth analysis of the development process, key features, and benefits of the MeTOS. The system aims to streamline diver management, enhance safety measures, and contribute to the sustainable growth of the local tourism industry. By offering real-time monitoring, data analytics, and communication tools, MeTOS empowers dive operators to provide a seamless and secure diving experience, ultimately promoting Mersing as a premier diving destination.
Keywords: Dive management system, web-based application, tourism operator system, diver management, information management.

1 Introduction

Mersing, situated in the southern state of Johor, Malaysia, boasts a remarkable coastline that stretches along the South China Sea, making it a popular destination for divers worldwide. Its proximity to renowned diving spots such as Pulau Tioman, Pulau Sibu, and Pulau Rawa has transformed Mersing into a diver's paradise. The region's coral reefs, diverse marine life, and underwater landscapes are a major draw for both amateur and experienced divers.

The rapid growth in the popularity of diving in Mersing has resulted in an increased number of tourists and divers flocking to the region. While this offers economic opportunities and promotes tourism, it simultaneously poses several challenges, such as the need for effective diver management and the preservation of the marine environment. The Mersing Tourism Operator System aims to address these challenges comprehensively.

The primary objective of the Mersing Tourism Operator System is to provide a robust and user-friendly platform for the efficient management of divers and their activities within the Mersing region. This system will offer numerous features and functionalities, including diver registration and verification, scheduling and coordination of dives, safety monitoring, and environmental impact assessment. By implementing this system, the authorities and dive operators in Mersing aim to enhance safety, protect the marine ecosystem, and ensure a sustainable future for diving tourism.

The significance of the Mersing Tourism Operator System extends beyond its immediate stakeholders. Firstly, it will significantly enhance the safety of divers by providing real-time monitoring and communication tools. Secondly, it will aid in the conservation of Mersing's marine biodiversity by regulating dive activities and assessing their environmental impact. Thirdly, it will streamline administrative processes for dive operators, reducing paperwork and enhancing their ability to provide quality services. Lastly, it will contribute to the promotion of sustainable tourism practices, aligning with Malaysia's commitment to responsible tourism.

The need for the Mersing Tourism Operator System is evident in the current challenges faced by local authorities, dive operators, and the marine ecosystem. The absence of a centralized management system has resulted in unregulated diving activities, overcrowding at popular dive sites, and potential harm to the environment. Moreover, without a standardized system, diver safety remains a concern. The increasing number of diving-related incidents and environmental degradation in Mersing highlight the urgency of implementing a comprehensive Diver Management System. The Mersing Tourism Operator System seeks to address these issues systematically and promote sustainable practices that will benefit divers, businesses, and the natural environment.

In conclusion, the development of the Mersing Tourism Operator System represents a significant step towards ensuring the sustainable growth of diving tourism in Mersing, Johor, Malaysia. This article introduces the system, outlining its objectives, significance, and the pressing need for its implementation. Subsequent sections of this research article will examine deeper into the system's features and development process.

2 Related Work

2.1 Web-based Application

The Mersing Tourism Operator system will be powered by web-based technologies. These web-based programs make use of a certain kind of software that enables users to communicate with a distant server using a web browser interface. A web-based application is essentially any application that runs over an HTTP network connection and can be accessed rather than being kept in memory on a device. A web browser is typically used to run web-based applications. Web-based apps can, however, also be client-based, in which case only a tiny portion of the software is downloaded to the user's computer, with all other processing taking place on a remote server connected to the internet. Web-based apps have a few benefits. One benefit is that creating a web-based application may be done at a

cheap cost. Through a web browser, users can access systems with web-based applications. While the application's user interface needs to be thoroughly tested across a range of web browsers. It is not required to develop and test it on every conceivable operating system variant and setup, though. Because of this circumstance, development and troubleshooting will be lot simpler. Because they are hosted on a server and do not need to be installed on local devices, web-based applications are also easy to set up and manage. Installing and updating will ultimately become less expensive. Web-based applications, on the other hand, can be accessed from any location if there is a web browser and an internet connection. This indicates that the application can be used on any internet-connected device, including a tablet and a mobile phone.

2.2 Comparative Analysis of Three Systems

This part will study about the existing systems that are similar to the system that will be developed which is diver management system for Mersing Johor Malaysia. By studying the existing system, comparisons can be made with other systems. There are several existing systems which are PADI Travel, Go Asia Diving and Sekawantravel. The three existing systems are studied and compared to the features of the proposed system. This includes the modules contained in the proposed system. The comparison results are shown in Table 1. All the three existing systems are web-based applications. Other than that, all the existing system also does not have login and registration, divers' management, management reports and user management module compared to Mersing Tourism Operator System.

Table 1: Comparison

Module	Go Asia Diving	PADI Travel	Sekawantravel	Mersing Tourism Operator System
Type of system	Web-based	Web-based	Web-based	Web-based
Login and registration module	Not available	Not available	Not available	Available
Dive Location Module	Available	Available	Available	Available
Booking Module	Available	Available	Available	Available
Island Module	Available	Available	Available	Available
Divers' Management Module	Not available	Not available	Not available	Available

Diver Operator Module	Not available	Not available	Not available	Available
User Access Level Module	Not available	Not available	Not available	Available
License Module	Not available	Not available	Not available	Available
Management Report Module	Not available	Not available	Not available	Available
Session Module	Not available	Not available	Not available	Available

3 Methodology

A methodological approach to project delivery is an organized methodology (Mohino et al., 2019). In the course of developing software, a programmer typically writes code to solve issues or automate processes (Wagner et al., 2018). Methodology describes the orderly procedures that must be followed when working on a project. The Software Development Life Cycle (SDLC) is essentially what the systematic procedure suggests to. Plans, analyses, designs, implementations, testing, and maintenance are among the phases that the SDLC focuses on. Therefore, the suggested system's development requires the appropriate technique. This section provides an overview of the project development phase and the activities that take place during each of these stages.

The Mersing Tourism Operator System project development will be assisted by the prototype process paradigm. The five phases of the system development life cycle methodology planning, analysis, design, prototype development, and implementation are all implemented via the prototype method. Figure 1 illustrates the phases in the prototyping model.

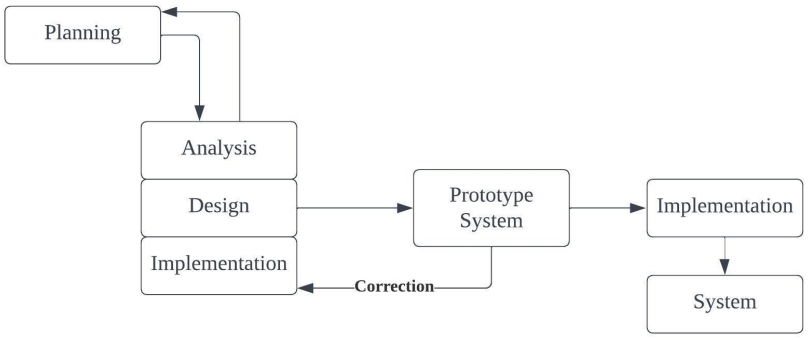


Figure 1: Prototyping Model

The prototype model contains a total of six phases. Table 2 shows that each phase has its own activities and deliverable that need to follow during the entire project development. Besides that, table 3 shows the milestone for each activity after completion. Basically, each of these phases must be completed successfully and with attention to detail in order for the project development to proceed without problems.

Table 2: Software Development Activities and Task

Phase	**Activity**	**Deliverables**
Planning	Identify problems, scope, and objectives.	- Gantt Chart - Proposal
Analysis	- Interview and observe client - Gather all the information	- Functional requirement - Non-functional requirement - Entity Relationship Diagram
Design	- Make the wireframe of the system before developing the system. - Design the interface of the system based on the requirement.	- Using Fluid UI to design the wireframe - Using PHP programing language to develop the system - Use MySQL to store the database - Interface of the system
Implementation	- Conduct testing of the system - Repair the fault of the system	- PHP programming
Prototype 1	- Detect error and any improvement that can be done to the system - Fix all the error that identified and proceed to Prototype 2 - If there any error or weaknesses, it will be repeated back to analysis phase	- Prototype system - Make sure system meet user requirement

Implementation and Testing	System administrator (committee from Majlis Daerah Mersing) will test the system.	- Test effectiveness of the system - Fix all the error immediately

Table 3: Activities that will be counted as milestones after completion

Initial Prototype	- Create a first prototype during the design phase. - Inspect it for flaws and make necessary improvements. - Refine the process further and conduct user testing until the user is pleased.	- PHP Programming - First prototype - Prototype version is updated
Final prototyping	Present the completed system to the panel.	Prototype system
Presentation	- Interview and observe client. - Gather all the information.	Final report and system completion

Functional requirements establish the function of the produced system, whereas function is defined as specified behavior that converts input to output. A functional requirement identifies a behavior or activity that the system must support (Guevara-Vega et al., 2019). Table 4 shows the proposed system's functional requirements.

Table 4: Functional requirement of developed system

No	Module	Description
1.	Login and registration module	- The system should enable users to log in using their registered username and password. - The system should only allow a user with a valid username and password to log in. - If there is any incorrect input, the system should notify the user. - Upon successful login, the system should send the user to that specific main menu. - New users should be able to register in the system.

		- The system should keep track of all the information entered by the user.
2.	Dive Location Module	- The system should display information about the location of the diving. - User can search find the location by using the given map.
3.	Island Module	- The system should display all island in Mersing Johor.
4.	Booking Module	- The system will allow the user to make a booking. - User can check the availability of the diving area.
5.	Divers' Management Module	- The system will allow the administrator to manage the information about the diver. - The detailed list of divers will be displayed at every booking section.
6.	Operator Module	- The system should provide information about the operator who will manage the booking for the diving area. - Only registered operator can be used the system.
7.	User Access Level Module	- The system should display all of the registered user's information. - The system should allow administrators to change and remove and manage all registered user.
8.	Management Report Module	- The system should provide the useful report that can be used by management in order to make a decision.
9.	License Module	- The system should provide information about diving license.
10.	Session Module	- The system should provide information about diving session.

Non-functional requirements specify the criteria used to assess the functioning of a system rather than the precise behavior or function of the system (Jarzębowicz et al., 2021). Table 5 shows the non-functional needs of the produced system.

Table 5: Non-functional requirement of developed system

No	Module	Description
1.	Performance	The system should be accessible at all times.

2.	Operational	A website's loading time should not exceed one minute.
3.	Security	The system should be able to safeguard all data.
4.	Compatibility	The system should be compatible with any web browser.

User requirements establish what the user expects from the system's functioning. Table 6 shows the created system's user needs.

Table 6: User needs of the developed system

No	User requirements
1.	To access the system, all users must be able to input a valid id and password.
2.	All new users must be able to sign up for the system.
3.	The Majlis Daerah Mersing system committee should be able to insert diving location information.
4.	The user should have access to all information regarding the diving site.
5.	The Majlis Daerah Mersing system committee should be able to insert island information.
6.	The user should have access to all information regarding the available island.
7.	The Majlis Daerah Mersing system committee should be able to insert diving license information.
8.	The user should have access to all information regarding the diving license.
9.	The appointed system operator should be able to insert the diver's information.
10.	The appointed system operator should be able to make a booking for divers.
11.	The appointed system operator should be able to print the booking confirmation.
12.	The Majlis Daerah Mersing system committee should be able to manage all the access level of the user.
13.	The Majlis Daerah Mersing system committee should be able to modify the information of the registered user.
14.	The Majlis Daerah Mersing system committee should be able to produce the management report. a. Diver Statistics by Nationality b. Diver Statistics by Dive Site c. Diver Statistics by Diver Age

3.1 Entity Relationship Diagram

A database or information system's entity-relationship diagram (ERD) shows how various entities (or objects), properties, and connections are connected to one another. To aid stakeholders in comprehending the structure and arrangement of data inside a system, ERDs are frequently used in database design and systems analysis. ERD is a common technique for data structures and database systems design (Qing Li et al., 2009). Figure 2 shows the use ERD for this system. There are 9 modules for the system which are login and registration module, dive location module, island module, booking module, divers' management module, package module, operator module, user access level module, management report module and license module.

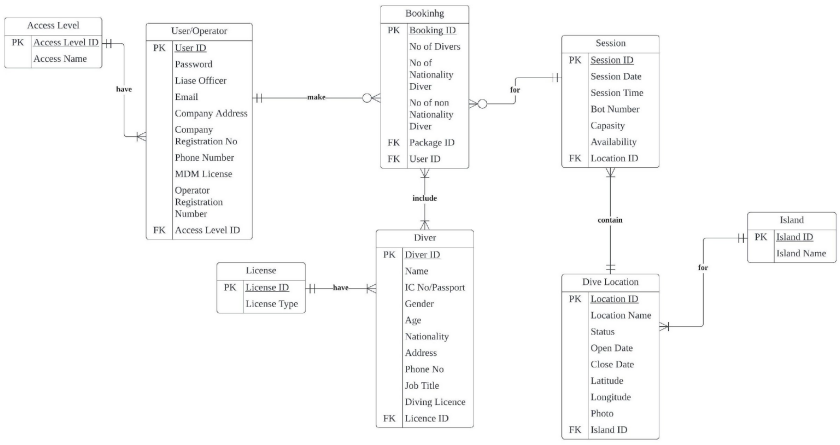


Figure 2: Entity Relationship for Mersing Tourism Operator System

3.2 System Architecture

A system's structure, behavior, and other aspects are defined by its system architecture, a conceptual model. Systems are required to adhere to a certain architecture, which serves as a description of the components of the system and how they communicate with one another (Mocrii et al., 2018). The Mersing Tourism Operator System's system architecture is depicted in Figure 3.

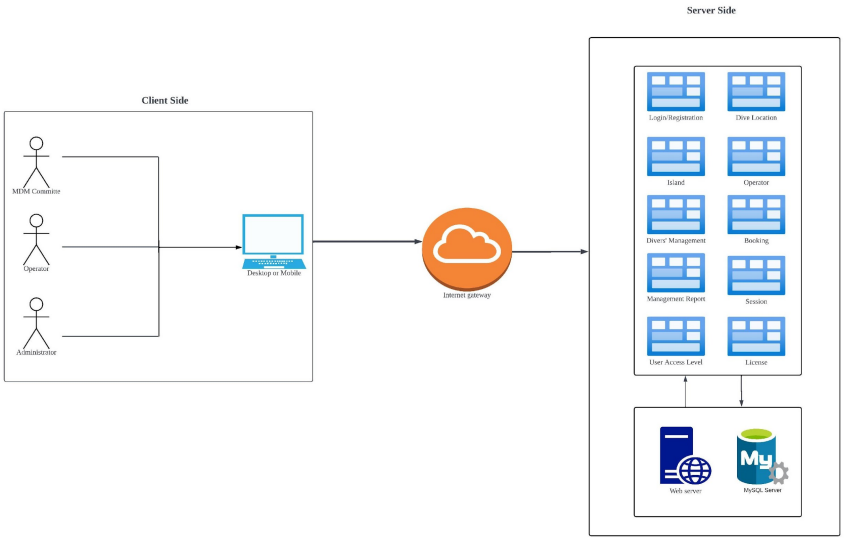


Figure 3: System Architecture for Mersing Tourism Operator System

4 Results and Discussion

4.1 System Implementation

The implementation phase is the phase in which a system is developed utilizing a programming language that was chosen at the start of system development. The system requirements specifications and design papers must constantly be referred to during the implementation process. HTML, a standard markup language for constructing web pages, is utilized for the building of the MeTOS, while PHP is used for the backend. MySQL is the database utilized by this system.

The fundamental flow of this system is that users must log in as one of two sorts of users: Majlis Daerah Mersing system committee and diving operator. The new diving operator can register by clicking the registration button. Dive Operator can access the information about dive location, dive section, make a booking, enter the diver information, update their information, and also print the booking confirmation. Figure 4 shows the Login/Registration Module for operator. Figure 5 shows the dive location module. Figure 6 shows the dive session module. Figure 7 shows the booking module. Figure 8 shows the diver information module. Figure 9 shows the booking confirmation module and Figure 10 shows the divers' module.

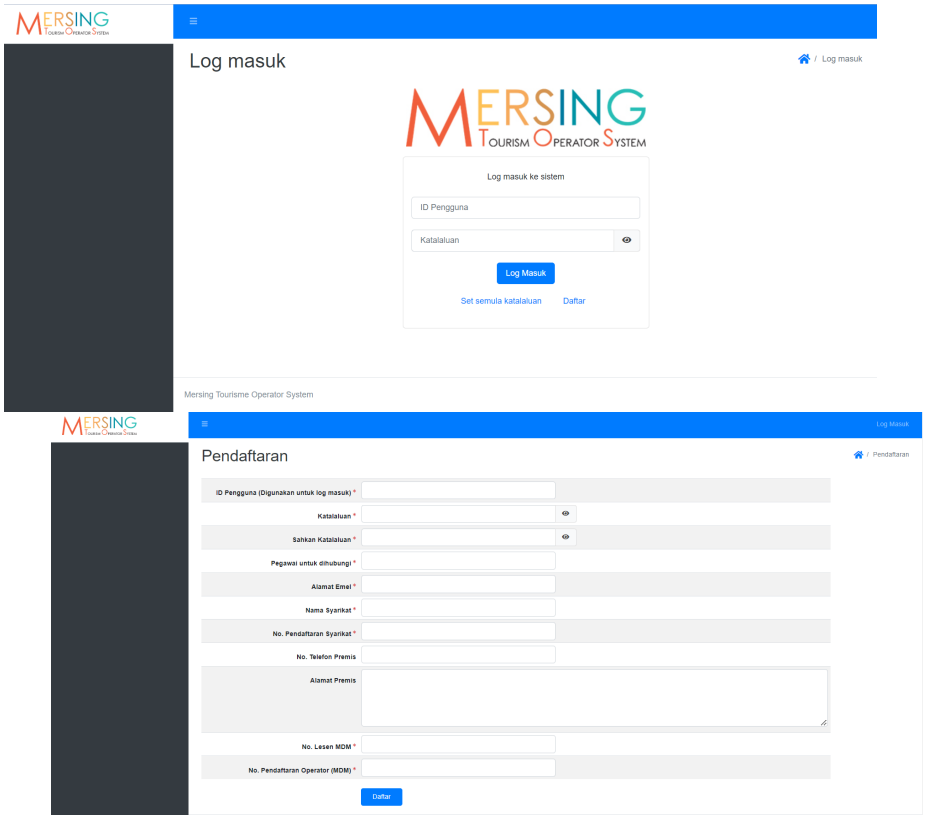
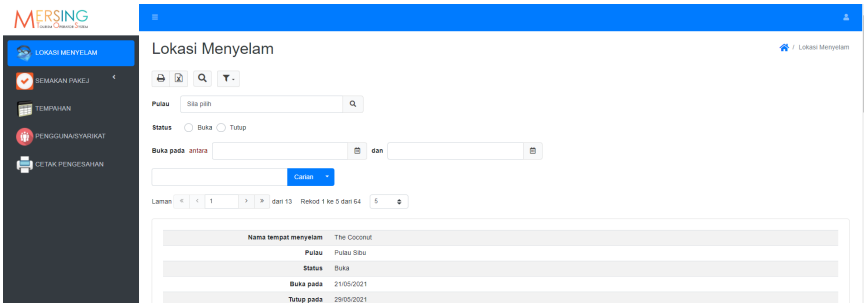


Figure 4: Login/Registration Module



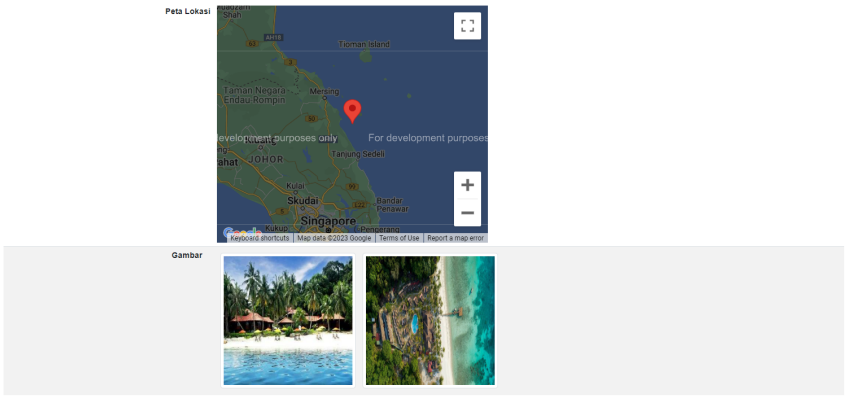


Figure 5: Dive Location Module

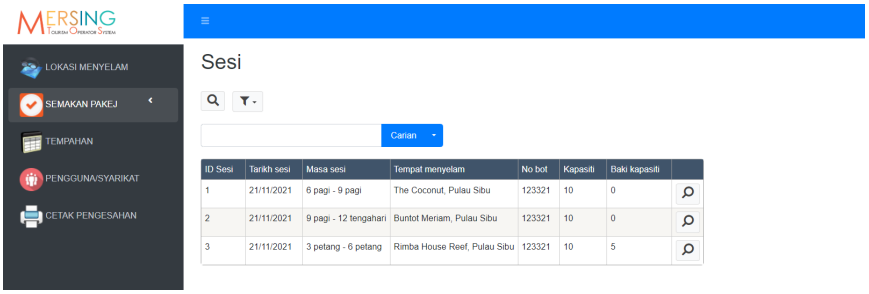


Figure 6: Dive Session Module

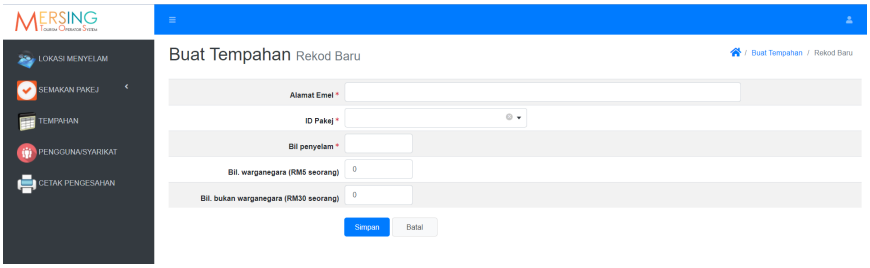


Figure 7: Booking Module

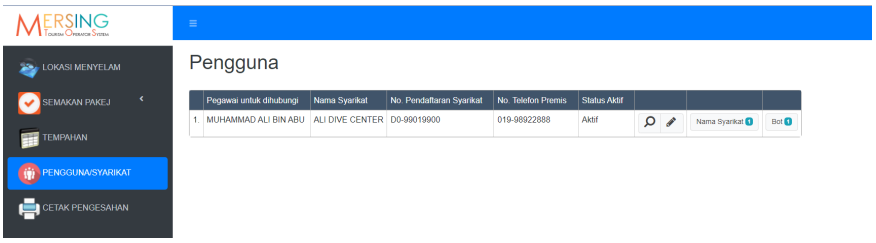


Figure 8: Diver Information Module

Figure 9: Booking Confirmation Module

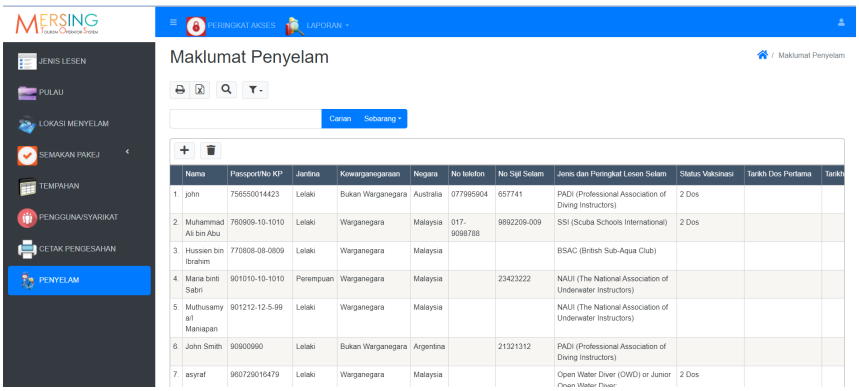


Figure 10: Divers' Module

Dive Operators have the ability to examine and change their own information in the dive operator module. They may also create a new booking and see their booking status. The dive operator may only observe the remaining modules.

There will be two levels of access to the Majlis Daerah Mersing system committee. One is for the administrator, and the other is for the super administrator. The administrator has access to all modules and may add, update, and remove records. Figure 11 shows the management report module.

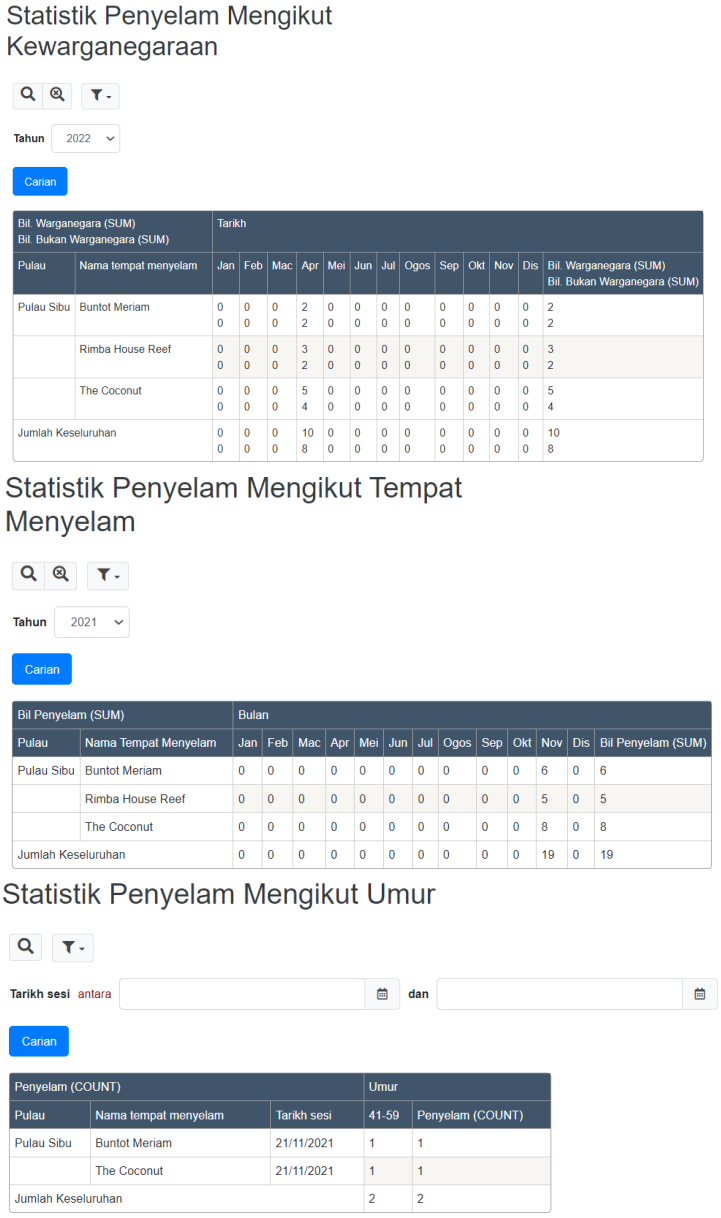


Figure 11: Management Report Module

All system privileges, including the user access level module, belong to the super administrator. The module for user access level is shown in Figure 12.

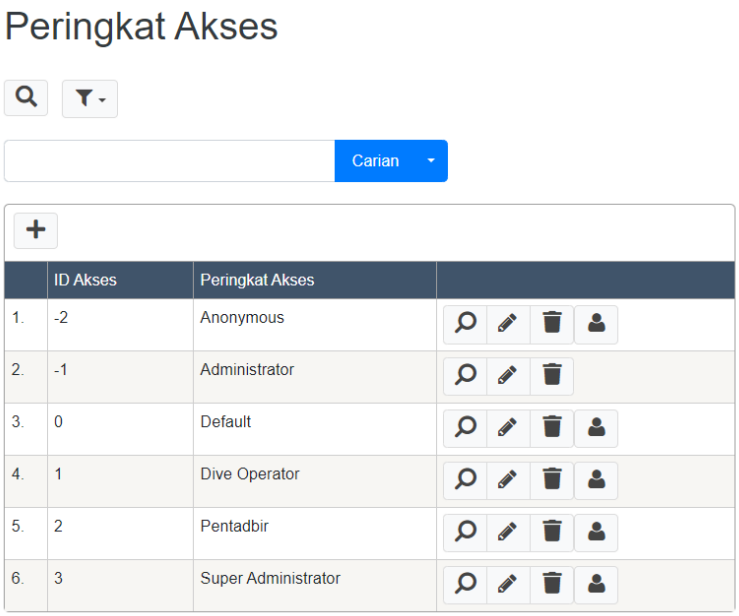


Figure 12: User Access Level Module

4.2 System Testing

System testing is the final step in the system development process. System testing is the process of determining whether or not a system has a problem. The results of testing on the Mersing Tourism Operator System will provide information on whether the system requirement has been fulfilled or not. The results of the tests are shown in Table 7. The test was conducted by one of the system committees, Encik Mohammad Yusof Bin Ab Majid.

Table 7: Performed Test

Test ID	Description	Result
Login/Registration 001	User logs in as super administrator, dive operator, or administrator. Registering as a new user on the system.	Successful
Login/Registration 001	When a user logs in with invalid data, an error message is shown by the system.	Successful

Dive Location 002	Administrators add, edit, and delete the dive location. System displays all the information about the dive location.	Successful
Island 003	Administrators add, edit, view, and delete the island information. System displays all the information about the island.	Successful
Booking 004	Dive Operators add and view the booking information. Administrators edit, view, and delete the booking information. System displays all the information about the booking.	Successful
Divers' Management 005	Dive Operators add, edit, view, and delete information about the divers in the booking details area. System displays all the information about the divers in the particular booking.	Successful
Dive Operator 006	Dive Operators edit and view their information. Administrator change activate the dive operator status in order to let them use the system. System displays all the information about the dive operator.	Successful
License 007	Administrators edit, view, and delete the license information. System displays all the information about the license.	Successful
Session 008	Administrators edit, view, and delete the dive session information. System displays all the information about the dive session.	Successful
Management Report 009	System displays all the information about the management reports.	Successful
User Access Level 010	The Super Administrator edits the information of the user and gives the access level. Super Administrator delete user.	Successful

5 Conclusion

The present manual system is no longer viable for usage since it loads Majlis Daerah Mersing employees and dive operators. He indicated his ambition to convert the present system to a digital platform in an interview with Yang Dipertua Majlis Daerah Mersing. As a result of this scenario, the Mersing Tourism Operator System for diver management in Mesing was implemented. The system may save all of the information related to the diving site, dive session, island information, diver information, and booking information. The Mersing Tourism Operator System was created to give a solution to Majlis Daerah Mersing's difficulties. By using an online system, all information on diving activities may be accessed more simply. The major aim for developing this system is to aid the Majlis Daerah Mersing in managing diver activity on Mersing's islands. Finally, the system runs well and meets the needs of the user.

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