



# Coastal and Marine Tourism Monitoring System Design using Rapid Application Development (RAD)

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Submitted: 25/12/2023; Accepted: 14/01/2024; Published: 22/01/2024

**Abstract**—To achieve sustainable tourism, a monitoring system of tourism activities is needed to minimize the environmental impact of the intensity of tourist visit activities. The development of coastal tourism needs particular attention, considering the diversity of activities around the coast related to environmental sustainability, including coral reefs. This study designed an information system and database to monitor coastal tourism activities to minimize the risk of damage to the coastal environment due to tourism activities. The method used in system design is Rapid Application Development (RAD), which has the following stages: requirement planning, user design, construction, and cutover. Meanwhile, the system and database design context is adjusted to the tourist destinations of Luari Beach, North Halmahera Regency, North Maluku Province, Indonesia. The results of this study show that identifying user needs at the requirements planning stage shows the need for a database of tourists visiting the destination and data related to the vehicles used. There is a need for a database related to beach conditions or beach environments and data on people involved as small entrepreneurs around coastal tourist areas. Considering the user's needs, at the user design stage, a prototype design is carried out using Oracle Apex with a dashboard display according to the data needed. At the construction stage, database configuration is carried out to display data visualization so that managers of beach tourist destinations understand the context and priority. System features and functions are tested at the cutover stage to evaluate application performance. The cutover result shows that successful applications can be used in decision-making. Thus, tourism destination managers take infrastructure development policies following existing conditions and short-, medium-, and long-term development plans.

**Keywords:** Special Interest; Coastal; Tourism; RAD; Information System; Database

## 1. INTRODUCTION

The urgency of research about the Coastal and Marine Tourism Monitoring System is paramount in light of the escalating challenges and opportunities within the coastal and marine tourism sectors. The main statement underscores the pressing need for a systematic and advanced monitoring system to address these dynamic environments' intricacies comprehensively. The proliferation of coastal tourism activities demands a sophisticated monitoring framework to capture and analyze visitor trends, environmental impacts, and community engagement data. The evolving nature of coastal and marine ecosystems requires adaptive systems capable of real-time data integration and spatial analysis. This research is essential for informed decision-making, sustainable management practices, and preserving the delicate balance between tourism development and environmental conservation. In conclusion, research on the Coastal and Marine Tourism Monitoring System is critical for advancing knowledge and developing practical tools to navigate the complex challenges facing these ecologically sensitive and economically vital destinations.

Coastal tourism in Indonesia has emerged as a pivotal economic driver, capitalizing on the nation's abundant natural beauty and diverse marine ecosystems [1]. The archipelagic country boasts a vast coastline that spans thousands of kilometers, encompassing picturesque beaches, coral reefs, and a unique marine biodiversity [2]. Coastal tourism development has generated employment opportunities, fostered local businesses, and contributed significantly to the national GDP [3]. However, addressing the environmental concerns associated with this burgeoning industry is imperative. Unregulated tourism activities, such as coral degradation and habitat destruction, may threaten fragile ecosystems [4]. Striking a balance between economic gains and sustainable practices is essential to ensure the long-term viability of coastal tourism in Indonesia [5]. In conclusion, while coastal tourism holds immense potential for economic growth, a concerted effort is needed to implement and enforce sustainable practices that safeguard the ecological integrity of Indonesia's coastal regions.

Coastal tourism resilience is critical to sustainable tourism management, particularly in regions prone to environmental vulnerabilities and climate change impacts [6]. The primary focus of coastal tourism resilience lies in building adaptive capacities to withstand and recover from natural disasters, such as hurricanes, tsunamis, and rising sea levels [7]. Implementing robust infrastructure, disaster preparedness plans, and community engagement initiatives are pivotal to fostering resilience in coastal tourism destinations [8]. This approach not only safeguards the livelihoods of local communities but also ensures the continuity of the tourism industry in the face of unforeseen challenges [9]. Nevertheless, it is crucial to recognize that achieving coastal tourism resilience requires a multidimensional and collaborative effort from various stakeholders, including government bodies, local communities, and the private sector [10]. In conclusion, by prioritizing resilience-building measures, coastal



tourism destinations can navigate the complexities of environmental uncertainties and sustain their attractiveness over the long term.

Coastal and marine tourism monitoring is an essential aspect of sustainable tourism management, aiming to track and assess the environmental impact and socio-economic dynamics of tourism activities in coastal and marine ecosystems [11]. The primary objective is to preserve delicate ecosystems and cultural heritage while optimizing the benefits derived from tourism [12]. Advanced monitoring systems, including remote sensing technologies and data analytics, play a crucial role in collecting real-time information on changes in water quality, biodiversity, and tourist activities [13]–[18]. These data-driven insights enable policymakers and stakeholders to make informed decisions and implement adaptive strategies for sustainable coastal and marine tourism development [17], [19]. However, successful monitoring hinges upon effective collaboration among government agencies, local communities, and the private sector [20]. In conclusion, a comprehensive and well-implemented monitoring framework is imperative to balance the economic advantages of coastal and marine tourism and the preservation of these ecosystems for future generations.

Implementing a tourism information system and database explicitly tailored for coastal and marine monitoring represents a pivotal stride in enhancing the sustainability of coastal and marine tourism [21]. The main objective of this specialized system is to amalgamate diverse data sources, ranging from satellite imagery to on-site monitoring, to comprehensively assess the environmental impact of tourism activities in coastal and marine ecosystems [22]. Such a system not only aids in real-time tracking of water quality, biodiversity, and tourist behaviors but also enables the formulation of adaptive management strategies [23]. Advocates posit that integrating advanced technologies, such as Geographic Information Systems (GIS) and Big Data analytics, empowers stakeholders with valuable insights, fostering a proactive approach to conservation [24]. However, reservations exist among critics who express concerns about the potential misuse of sensitive environmental data and the need for stringent privacy safeguards [25]. In conclusion, a well-designed Tourism Information System and Database for Coastal and Marine Monitoring is an indispensable tool for ensuring the delicate equilibrium between economic gains from tourism and the preservation of these ecologically critical areas.

Developing a Geographic Information System (GIS) and Big Data infrastructure for coastal and marine tourism monitoring signifies a significant advancement in sustainable tourism management. The primary objective of this innovative system is to integrate and analyze vast datasets related to coastal and marine ecosystems, providing stakeholders with a comprehensive understanding of the dynamic interactions between tourism activities and the environment [26]. Through GIS technology, spatial data on tourist movements, habitat conditions, and environmental parameters can be efficiently mapped and visualized, offering valuable insights for decision-makers [27]. Big Data analytics further enhances the system's capacity to process large volumes of information, enabling real-time monitoring and adaptive management strategies [28]. Proponents assert that this technological integration empowers stakeholders to make informed decisions that balance economic interests with environmental conservation [29]. However, critics express concerns about data security, privacy, and the potential for technological solutions to replace the nuanced judgment required for sustainable tourism practices [30]. In conclusion, developing a GIS and Big Data coastal and marine tourism monitoring system holds promise for fostering a more resilient and ecologically sensitive approach to tourism management. However, the careful consideration of ethical and privacy implications is paramount.

Based on the existing literature, the primary aim of this research is to design a comprehensive database and information system for monitoring coastal and marine tourism areas. The foundational premise stems from recognizing the growing importance of sustainable tourism management, necessitating advanced technological solutions to address the complex interactions between tourism activities and fragile coastal and marine ecosystems. The literature underscores the significance of a well-structured database in amalgamating diverse sources of information, ranging from environmental parameters to tourist behaviors. By employing information systems, particularly those integrating Geographic Information Systems (GIS) and Big Data analytics, the research aspires to provide a tool that not only aids in real-time monitoring but also facilitates evidence-based decision-making for stakeholders. While the literature supports the necessity of such systems for fostering sustainable practices, it also acknowledges the need for continuous refinement and ethical considerations in implementing technological solutions for tourism management. In conclusion, this research contributes to the existing body of knowledge by proposing a system that aligns with the current discourse on sustainable coastal and marine tourism, emphasizing the importance of meticulous design and ethical implementation for effective and responsible management.

The database and information system design is anchored in a case study conducted at Luari Beach, North Halmahera Regency, North Maluku Province, Indonesia. The main impetus behind selecting Luari Beach as the focal point lies in its significance as a representative coastal tourism site facing diverse environmental and socio-economic challenges. The literature highlights the importance of contextualizing such systems within specific geographical and cultural contexts to ensure their relevance and effectiveness. By focusing on Luari Beach, the research aims to elucidate the applicability and adaptability of the proposed database and information system in a real-world setting, providing valuable insights for sustainable coastal and marine tourism management. The choice of Luari Beach is justified by its emblematic status as a microcosm of the broader challenges coastal tourism destinations face. In conclusion, the case study approach enhances the practical utility of the research outcomes,

contributing to the development of tailored solutions that address the nuanced intricacies of coastal and marine tourism in the unique context of Luari Beach.

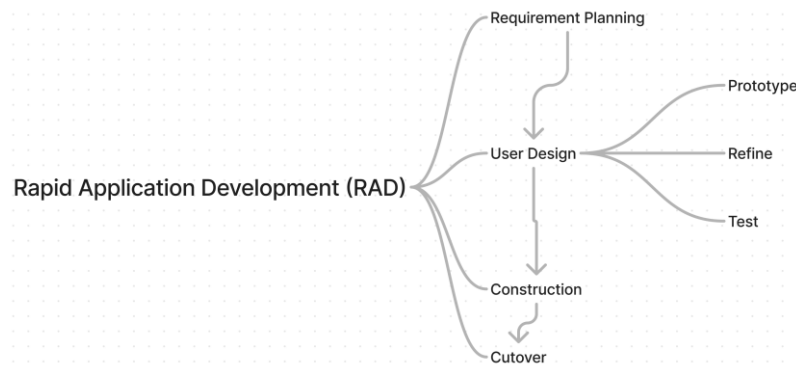
The limitation of this research lies in the database design, which exclusively employs the Oracle APEX application and the utilization of QGIS for remote sensing applications. The primary constraint is the software choices for developing the database and the remote sensing component. While Oracle APEX offers a robust and user-friendly platform for database design, the research could benefit from a comparative analysis with other database management systems for a more comprehensive evaluation of available options. Additionally, using QGIS for remote sensing applications could be considered limiting, as alternative tools and software exist in the remote sensing domain. Nevertheless, these choices were made based on feasibility, accessibility, and the compatibility of the selected applications with the research objectives. In conclusion, while acknowledging these limitations, the chosen software applications are deemed appropriate for achieving the research goals, and their application serves as a pragmatic approach within the scope and resources available for this study.

The primary recommendation for further research is to design a comprehensive monitoring system for tourism activities in forested areas and cultural heritage sites. The imperative stems from recognizing the increasing importance of sustainable tourism management in ecologically and culturally sensitive zones. Subsequent studies could focus on integrating advanced technologies, including Geographic Information Systems (GIS) and remote sensing applications, to develop a robust monitoring framework. This would facilitate real-time data collection and analysis to assess the impact of tourism on forest ecosystems and cultural heritage sites. Furthermore, incorporating community engagement strategies and participatory approaches could enhance the effectiveness of the monitoring system by integrating local perspectives and ensuring the socio-cultural sustainability of tourism activities. Despite the challenges posed by technology integration in these diverse environments, the potential benefits of informed decision-making and the preservation of natural and cultural assets make this research line crucial for advancing sustainable tourism practices. In conclusion, further exploration could contribute significantly to the evolving discourse on responsible tourism management in forested areas and cultural heritage sites.

## 2. RESEARCH METHODOLOGY

### 2.1 Rapid Application Development (RAD)

Implementing the Rapid Application Development (RAD) method in the database and information system design for monitoring coastal and marine tourism activities marks a strategic approach in expediting the development process and adapting to evolving project requirements. The primary advantage of employing RAD is its iterative and flexible nature, allowing for continuous feedback and modifications during the development cycle [31]. This approach proves advantageous in the dynamic context of coastal and marine tourism, where changing environmental conditions and emerging data needs require agile and responsive solutions. Despite the recognized benefits, it is essential to acknowledge that RAD may pose challenges regarding potential trade-offs between speed and the thoroughness of the system design [32]. However, the iterative nature of RAD allows for ongoing refinements, ensuring that the system aligns closely with the evolving demands of coastal and marine tourism monitoring. In conclusion, implementing the RAD method is considered a pragmatic choice, balancing efficiency and adaptability for successfully developing a responsive and effective monitoring system in the complex context of coastal and marine tourism.



**Figure 1.** Rapid Application Development (RAD)

Figure 1 describes the Rapid Application Development (RAD) method, which encompasses several stages, from requirement planning, user design, construction, and the cutover phase. In the initial stage of requirement planning, the focus is on eliciting and documenting the functional and non-functional requirements of the system. Subsequently, in the user design phase, end-users actively create prototypes and user interfaces, ensuring that the system aligns with their expectations and needs. The construction phase involves the actual development of the



system, with an emphasis on iterative cycles for quick prototyping, testing, and refinement. Finally, the cutover phase marks the transition from the development to the live operational environment. RAD proponents laude its agility and adaptability to changing requirements, while critics raise concerns about potential oversights in the pursuit of speed. Nevertheless, the defined stages in the RAD method provide a structured framework for efficient and responsive application development. In conclusion, the systematic progression through these stages enables a dynamic and iterative approach that caters to the evolving demands of system development within the context of Rapid Application Development.

### 2.1.1 Requirement Planning Phase

In the requirement planning phase, identifying user needs is pivotal in designing the database and information system for the Coastal and Marine Tourism Monitoring System. The main statement highlights the fundamental role of this initial phase in laying the groundwork for a system that aligns with stakeholders' diverse and specific needs. Supporting this assertion, a comprehensive understanding of user requirements ensures that the subsequent phases of system development are tailored to address the intricate challenges and functionalities associated with coastal and marine tourism monitoring. In addition, the significance of a user-centric approach in fostering system usability, functionality, and overall effectiveness. In conclusion, the meticulous identification of user needs during the requirement planning phase is foundational, guiding the subsequent stages of development to create a Coastal and Marine Tourism Monitoring System that is not only technically robust but also responsive to the practical needs of its users, as table below.

**Table 1.** User Requirement for Database and Information System

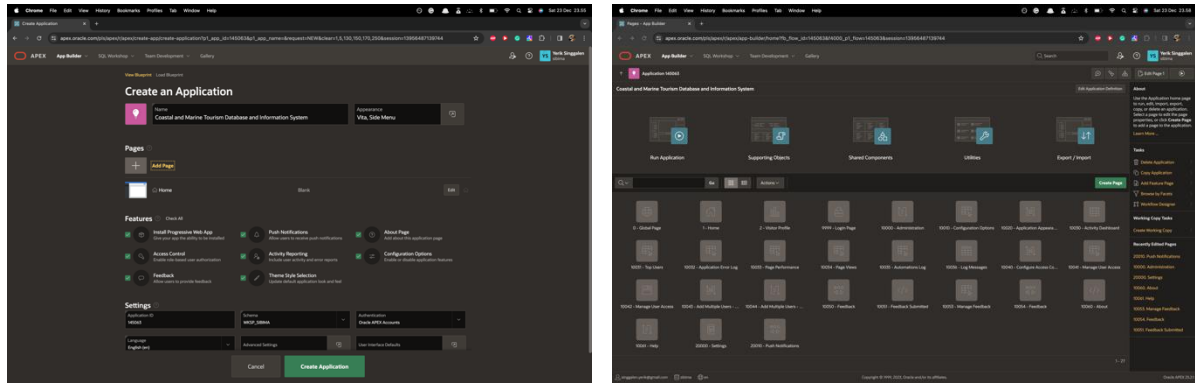
Data Requirement	Goals/Purposes	Description
Visitors Data	Tracking Visit Trends	Data visualization provides insights into the number of visitors over time, helping to identify peak and off-peak seasons.
	Visitor Profiles	Understanding visitors' origin, demographics, and preferences to tailor marketing strategies and services.
	Visitor Satisfaction Levels	Collecting and analyzing visitor feedback to improve the quality of services and their overall experience.
Visitors Vehicles	Traffic Flow	Tracking the number of vehicles entering and leaving to manage traffic and parking effectively.
	Emissions and Environmental Impact	Monitoring the types of vehicles and measuring the impact of greenhouse gas emissions and air quality to evaluate environmental effects.
Local Community	Local Economy	Analyzing the impact of tourism on the local economy, including job creation, income, and business opportunities.
	Community Engagement	Assessing the response and involvement of the local community in the tourism industry and identifying ways to enhance the benefits for the local community.
Local Environment	Sustainability	Monitoring sustainable practices and the impact of tourism on the local environment to ensure responsible tourism.
	Nature Conservation	Identifying vulnerable areas and taking steps to protect biodiversity and the environment's natural beauty.

Table 1 describes the user and data requirements regarding visitors' profiles, visitor vehicles, local communities, and local environments. Based on the outcomes of user needs identification concerning the database and information system, the primary focus in RAD implementation is intricately linked to the visitors' profile, vehicle, local community, and local environment. The main thrust of the implementation lies in addressing the specific requirements and preferences of various stakeholders involved in the tourism domain. The visitors' profile component aims to capture and analyze visitor demographics, behaviors, and preferences data, providing valuable insights for tailoring tourism strategies. Simultaneously, the visitors' vehicle module concentrates on managing the impact of transportation on the local environment and infrastructure. The local community segment emphasizes the integration of community perspectives and engagement to ensure the socio-cultural sustainability of tourism initiatives. Lastly, the local environment aspect concentrates on monitoring and preserving the ecological integrity of the destination. This targeted approach within the Rapid Application Development (RAD) framework aligns with the identified user requirements, ensuring a responsive and adaptive system tailored to the multifaceted dimensions of tourism management.

### 2.1.2 User Design Phase

In the user design phase, the meticulous crafting of the interface for the Coastal and Marine Tourism Monitoring System takes center stage. The main statement underscores this phase's critical nature in shaping the application's visual and interactive components. Supporting this assertion, the user design process involves translating identified

user requirements into an intuitive and user-friendly interface that accommodates the diverse needs of stakeholders. This phase prioritizes aesthetic considerations and focuses on functionality, ensuring that the interface enhances user experience and facilitates seamless interaction with the monitoring system. In addition, the importance of user-centric design principles in promoting accessibility, efficiency, and overall user satisfaction. In conclusion, the user design phase is pivotal in developing the Coastal and Marine Tourism Monitoring System, ensuring that the resultant interface aligns harmoniously with user expectations and operational requirements, as shown below.



**Figure 2.** Prototype of Database and UI Design in Oracle-Apex Application

The prototype is crafted using Oracle APEX on the data and information requirements during construction. In this pivotal stage of the Rapid Application Development (RAD) method, the primary emphasis is placed on the actual development of the system. Oracle APEX serves as a robust tool for this purpose. The prototype design aligns with the identified user needs, allowing quick and iterative development cycles. A user-friendly interface is created through Oracle APEX, facilitating seamless interaction and engagement with the system. This application of Oracle APEX ensures efficiency and responsiveness in constructing a prototype that encapsulates the envisioned functionalities and features. The choice of Oracle APEX is strategic, acknowledging its capability to streamline the construction process while catering to the diverse data and information requirements inherent in developing a monitoring system for coastal and marine tourism. In conclusion, using Oracle APEX in the construction phase is deemed a judicious decision, contributing to the overall effectiveness of the prototype development within the RAD framework.

### 2.1.3 Construction Phase

In the construction phase, adjustments between the system design, operator functions, and user requirements are implemented to refine the Coastal and Marine Tourism Monitoring System. The main statement emphasizes the active development stage, where the theoretical designs are translated into a functional and cohesive system. Supporting this assertion, construction involves aligning the system's technical specifications with the practical needs of operators and end-users, ensuring that the implemented features comprehensively address the identified requirements. This iterative process fosters a dynamic and responsive system that accommodates evolving user needs and operational functionalities. In addition, continuous communication and collaboration between developers, operators, and users during this phase are essential to enhance system adaptability and overall performance. In conclusion, the construction phase plays a pivotal role in bridging the gap between design concepts and practical usability, resulting in a Coastal and Marine Tourism Monitoring System that effectively meets the expectations and requirements of its intended users.

The opportunity for modifications remains viable, mainly when there is a need for diverse chart visualizations or adding pages in the Coastal and Marine Tourism Monitoring System. The main statement underscores the dynamic nature of the construction stage, allowing for flexibility in adapting the system to emerging requirements. Supporting this assertion, the construction phase enables developers to respond to evolving needs related to data visualization by incorporating varied chart formats and expanding the system's informational architecture. This flexibility ensures that the Coastal and Marine Tourism Monitoring System remains adaptable and capable of accommodating changing demands for information representation. This adaptability is crucial because it fosters a system that meets current needs and anticipates future requirements in the ever-evolving landscape of coastal and marine tourism monitoring. In conclusion, the construction phase serves as a crucial period for refining and enhancing the system's capabilities, ensuring its resilience in addressing the complexities of data visualization and expanding content requirements.

### 2.1.4 Cutover Phase

In the cutover phase, the designed coastal and marine tourism monitoring system undergoes comprehensive testing to ensure the seamless functionality of all processes within the application. The primary objective of this stage is to transition the system from the development environment to the live operational setting, necessitating meticulous

examination of its operational readiness. Rigorous testing is conducted to validate the integrity and accuracy of data processing, user interfaces, and overall system performance. This phase is crucial for identifying and rectifying potential glitches, ensuring the monitoring system operates effectively in real-world conditions. Opinions may vary on the duration and intensity of testing required. Still, the consensus underscores the significance of a thorough cutover phase to mitigate risks and optimize the reliability of the coastal and marine tourism monitoring system. In conclusion, carefully executing the cutover phase is a pivotal step in successfully implementing the monitoring system, safeguarding its functionality and reliability for sustainable tourism management.

Each function and feature undergoes rigorous testing to ensure a seamless implementation of the Coastal and Marine Tourism Monitoring System. The main statement highlights the critical nature of this phase, marking the transition from development to live operation. Supporting this assertion, the cutover phase involves meticulously examining all system functionalities to identify and rectify potential issues, ensuring the system operates smoothly in real-world scenarios. This testing process encompasses not only individual functions but also the integration of features to guarantee their cohesive and error-free performance. Thorough testing during cutover is essential as it serves as a final checkpoint to validate the readiness of the Coastal and Marine Tourism Monitoring System for operational deployment. In conclusion, the cutover phase plays a pivotal role in fortifying the reliability and functionality of the system, ensuring a successful and effective transition from development to active implementation.

### 3. RESULT AND DISCUSSION

#### 3.1 Coastal and Marine Tourism Destination: Case of Luari Beach in North Halmahera Regency

Tourism in North Halmahera Regency has undergone significant development parallel to the increasing intensity of domestic tourist visits and growing interest in beach tourism activities [33]. This progression can be regarded as a response to the abundant natural potential within the region, encompassing picturesque beaches and diverse marine ecosystems [34]. The rising interest of domestic tourists in exploring the natural and cultural beauty offered by North Halmahera Regency creates substantial economic opportunities for the local communities [35]. The heightened interest in coastal and marine tourism also reflects a shift in tourist preferences toward destinations that offer authentic natural experiences and recreational activities by the seaside [36]. Thus, tourism development in North Halmahera Regency signifies industrial growth and underscores the importance of environmental and cultural preservation in managing sustainable tourism growth.

Luari Beach is one of the most frequently visited destinations for local tourists in coastal and marine tourism, contributing to heightened community engagement and local economic development. This popularity is attributed to the inherent allure of Luari Beach, which boasts pristine coastal landscapes and a rich marine environment. The frequent influx of local tourists indicates the destination's widespread appeal and transformative impact on the local community and economy. The increased visitation stimulates economic activities such as local businesses, hospitality services, and the sale of artisanal products. The sustained popularity of Luari Beach underscores its pivotal role in fostering a sense of community pride and identity, as residents actively participate in and benefit from tourism-related economic opportunities. In conclusion, the significance of Luari Beach extends beyond its natural beauty, portraying the symbiotic relationship between tourism and local development in the coastal and marine context.



**Figure 3.** Luari Beach of North Halmahera Regency, North Maluku Province, Indonesia

Figure 3 describes Luari Beach, which features the distinct characteristics of white sandy beaches and the captivating beauty of the underwater landscape adorned with exquisite coral reefs. The main allure of Luari Beach lies in its pristine, sun-kissed shores and the remarkable underwater ecosystem that adds to its allure. The white sandy beaches offer visitors a serene and visually pleasing environment for recreational activities and relaxation. Moreover, the enchanting coral reefs beneath the clear waters contribute to the ecological richness of the area, providing a habitat for diverse marine life and creating an immersive experience for snorkelers and divers. The unique combination of white sandy beaches and vibrant coral reefs enhances the overall appeal of Pantai Luari,

positioning it as a coveted destination for those seeking both natural tranquility and vibrant marine exploration. In conclusion, the distinctive characteristics of Luari Beach not only contribute to its aesthetic charm but also underscore its ecological significance in the context of coastal and marine tourism.



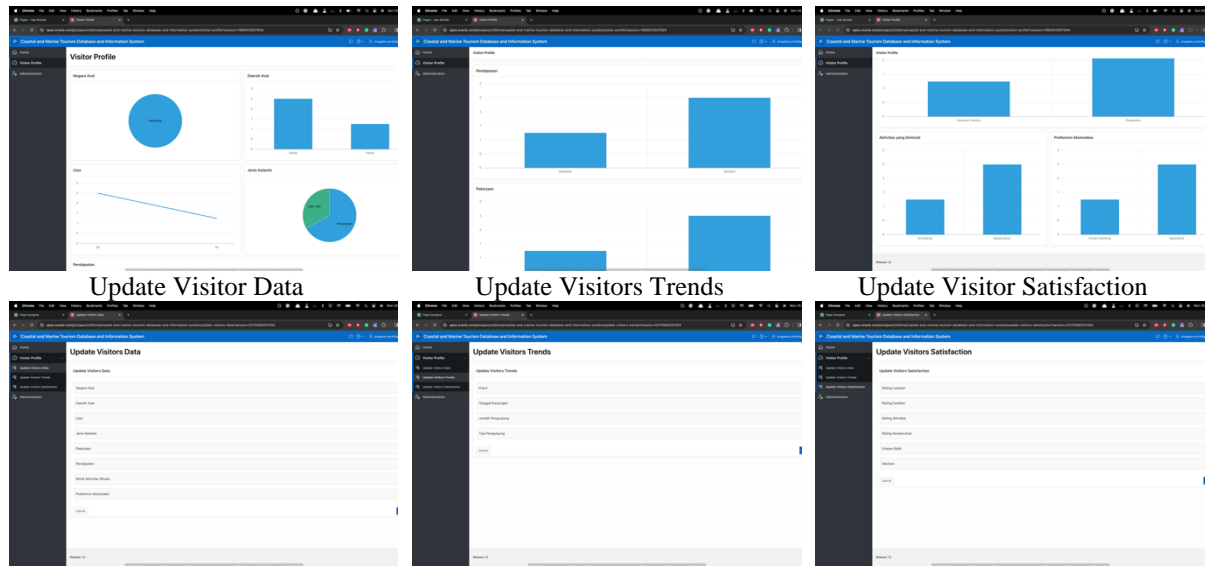
**Figure 4.** Challenges in Coastal and Marine Tourism Destination Management

Luari Beach management faces four distinct challenges: visitor data management, visitor vehicle arrangement, environmental organization, and the enhancement of local community participation. The primary challenge lies in systematically collecting and managing visitor data, necessitating effective mechanisms for tracking visitor demographics and behaviors. Furthermore, arranging visitor vehicles poses logistical challenges, requiring thoughtful planning to mitigate congestion and ensure efficient transportation infrastructure. Environmental organization entails preserving Luari Beach's natural beauty and protecting its ecosystems, demanding sustainable practices to safeguard the destination's ecological integrity. Addressing these challenges requires collaborative efforts from various stakeholders, incorporating technology for efficient data management, implementing traffic control measures, instituting sustainable environmental policies, and fostering active involvement of the local community. In conclusion, recognizing and strategizing solutions to these challenges are imperative for the successful and sustainable management of Luari Beach as a coastal tourism destination.

### 3.2 Implementation of Rapid Application Development: Coastal and Marine Tourism Destination Monitoring System

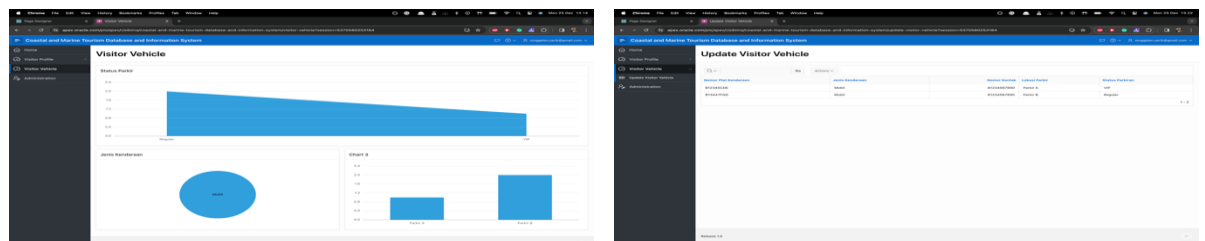
Visitor data are essential in comprehending tourists' consumption behaviors or purchasing patterns when visiting Luari Beach. The primary rationale behind the need for visitor profiles lies in the intricate understanding of diverse aspects of tourists, such as their demographics, preferences, and spending behaviors. Developing comprehensive visitor profiles enables destination managers to tailor their services and offerings to align with the specific needs and interests of the target audience. Through analyzing visitor profiles, one can gain insights into the amenities, activities, or services most appealing to the visitors, facilitating strategic decision-making for the sustainable development and management of Luari Beach as a tourism destination. In conclusion, the creation and analysis of visitor profiles serve as a foundational tool for optimizing the tourist experience and ensuring the long-term success of Luari Beach as a sought-after destination.

There are three crucial aspects related to visitor data: Tracking Visit Trends, Visitor Satisfaction Levels, and Visitor Demographics. The main focus lies in comprehending the dynamics of visitor behavior and preferences. Tracking Visit Trends allows destination managers to discern patterns in visitation, aiding in capacity planning and resource allocation. Simultaneously, gauging Visitor Satisfaction Levels provides valuable insights into the quality of the tourist experience, enabling improvements in services and facilities. Moreover, understanding Visitor Demographics offers a comprehensive view of the diverse visitor profiles, aiding in targeted marketing and tailored offerings. The significance of these aspects asserts that a holistic analysis of visitor data is pivotal for informed decision-making and the sustainable management of tourism destinations. In conclusion, a multifaceted approach to visitor data ensures a nuanced understanding of the visitor experience, continually fostering strategic initiatives to enhance tourism offerings.



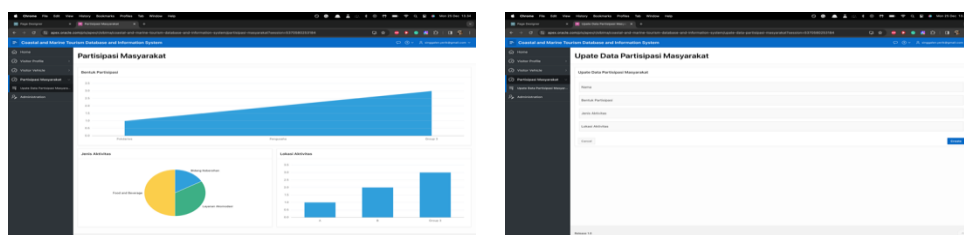
**Figure 5.** User Interface of Visitor Data Dashboard and Update Page

The interface design in the Coastal and Marine Tourism Destination Monitoring System is tailored to meet the specific needs of tracking visit trends and assessing visitor satisfaction levels. The primary focus lies in creating an intuitive and user-friendly interface that facilitates the efficient tracking of visitation patterns and provides a platform for collecting valuable feedback on visitor experiences. The interface incorporates features for real-time data visualization, enabling destination managers to analyze trends in visitation and promptly respond to emerging patterns. Additionally, the design integrates user-friendly feedback mechanisms to gauge visitor satisfaction levels, allowing for the continuous improvement of services and amenities. A well-designed interface is critical for optimizing the functionality of the monitoring system, enhancing its usability, and ensuring adequate data collection for strategic decision-making in the management of coastal and marine tourism destinations. In conclusion, the thoughtful design of the interface serves as a linchpin for the success and practicality of the Coastal and Marine Tourism Destination Monitoring System in meeting its intended objectives.



**Figure 6.** User Interface of Visitors Vehicles Dashboard and Update Page

Figure 6 is the user interface of the visitors' vehicle dashboards and update pages in the application. The interface design of the Coastal and Marine Tourism Destination Monitoring System is customized to address the specific requirements related to visitor vehicles, considering the location of parking areas that necessitate extra security measures. The primary objective is to create an interface that systematically tracks and manages visitor vehicles within the destination. This entails incorporating real-time parking occupancy monitoring, security camera integration, and efficient traffic flow management. The supporting features in the interface aim to enhance the overall safety and security of visitor vehicles, especially in areas where additional precautions are warranted. The critical role of such tailored interface design in optimizing the monitoring system's functionality provides a comprehensive solution to address the challenges associated with visitor vehicle management in coastal and marine tourism destinations. In conclusion, the meticulous design of the interface aligns with the imperative to enhance security measures and streamline visitor vehicle logistics within the broader framework of the monitoring system.



**Figure 7.** User Interface of Local Community Participation Dashboard and Update Page

Figure 7 shows the user interface of the local community participation dashboard and update page. The interface design of the Coastal and Marine Tourism Destination Monitoring System is tailored to meet the specific requirements for local community participation, taking into account the role of the community as entrepreneurs supporting economic growth in Luari Beach. The primary emphasis lies in creating an interface that fosters active engagement and collaboration between the local community and the monitoring system. Supporting features include platforms for community input, feedback mechanisms, and data-sharing capabilities. This approach acknowledges the local community as integral stakeholders and entrepreneurs, contributing to the economic vitality of Luari Beach. Community involvement in tourism management is essential for economic purposes and for fostering a sense of ownership and sustainable practices. In conclusion, the thoughtful design of the interface serves as a strategic tool to empower the local community, aligning with the principles of responsible and community-oriented coastal and marine tourism destination management.



**Figure 8.** User Interface of Local Environment Dashboard, Update and Report Page

Figure 8 shows the user interface of the local environment dashboard, update, and report page. The interface design of the Coastal and Marine Tourism Destination Monitoring System is meticulously tailored to address the specific requirements for local environment monitoring, considering the managerial responsibility to preserve environmental sustainability. The central focus is creating an interface that facilitates the real-time tracking and assessment of environmental parameters crucial to the local ecosystem's health. Supporting features encompass data visualization tools for monitoring water quality, biodiversity, and ecological changes. This design approach recognizes the critical role of responsible environmental management in coastal and marine tourism. The significance of integrating environmental monitoring features is not only a compliance measure but a proactive strategy to balance tourism development with preserving the natural surroundings. In conclusion, the thoughtful interface design aligns with the commitment to environmental stewardship, ensuring that the Coastal and Marine Tourism Destination Monitoring System contributes to the sustainable coexistence of tourism and the local environment.

During the Construction phase, the data structure is adjusted to meet the requirements for addressing issues related to visitors, vehicles, local participation, and the local environment. The main objective is to develop a robust database structure that aligns seamlessly with the complexities of coastal and marine tourism management. The data structure is tailored to capture and manage visitor profiles, vehicle tracking, community engagement, and environmental monitoring information efficiently. This customization ensures that the Coastal and Marine Tourism Destination Monitoring System effectively addresses the multifaceted challenges inherent in sustainable tourism development. This meticulous adjustment of the data structure is pivotal for enhancing the system's functionality and responsiveness in addressing the diverse needs of stakeholders. In conclusion, the construction phase is critical in refining the data structure and laying the foundation for a comprehensive and effective monitoring system in coastal and marine tourism.

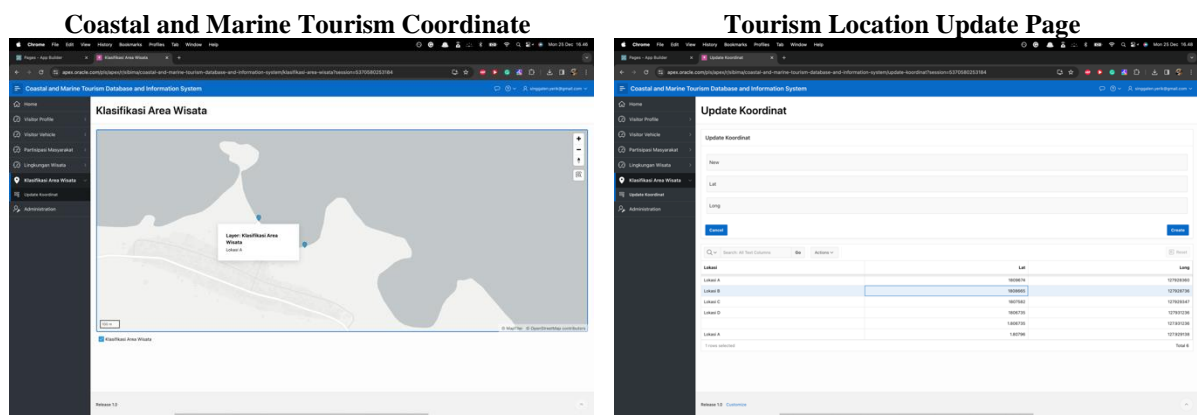
Data visualization and operational functions are rigorously tested during the Cutover phase to ensure the application's usability. The primary objective is to assess the readiness of the Coastal and Marine Tourism Destination Monitoring System for live operational use. Thorough testing is conducted to validate the accuracy and efficiency of data visualization features, ensuring that stakeholders can interpret information seamlessly. Additionally, operational functions are scrutinized to guarantee the smooth and reliable performance of the system in a real-world setting. This testing phase is crucial for identifying and rectifying potential issues, optimizing the user experience, and ensuring that the Coastal and Marine Tourism Destination Monitoring System functions seamlessly upon implementation. The significance of this meticulous testing process underscores its role in fortifying the system's reliability and usability. In conclusion, the Cutover phase serves as a critical checkpoint, validating the effectiveness of the application and ensuring its readiness for operational use in the dynamic context of coastal and marine tourism management.

### **3.3 Discussion: Integration of Geographic Information System (GIS) and Tourism Destination Database**

Based on the results of the discussion on integrating GIS with the database, it becomes evident that there is a facilitative aspect for policymakers in terms of visualizing tourist areas to optimize monitoring and decision-making processes. The main statement emphasizes the outcome derived from the collaborative discourse, shedding light on the advantages of the integration. Supporting this assertion, integrating GIS and the database provides

policymakers with a user-friendly and visually intuitive platform, enhancing their ability to comprehend and analyze tourist areas efficiently. This streamlined visualization process proves instrumental in optimizing the monitoring efforts and expediting decision-making processes related to coastal and marine tourism. The pivotal role of this integrated approach in empowering policymakers to make well-informed decisions, thus contributing to the sustainable management of tourism destinations. In conclusion, integrating GIS with the database emerges as a strategic tool, providing policymakers with enhanced capabilities for visualizing tourism areas, thereby optimizing monitoring practices and decision-making processes in coastal and marine tourism.

To obtain a comprehensive overview of tourist locations, the database is integrated with Geographic Information System (GIS) to optimize monitoring functions. The main objective is to enhance the capabilities of the Coastal and Marine Tourism Destination Monitoring System in capturing, analyzing, and visualizing spatial data related to tourist activities. In addition, GIS integration allows for efficient mapping of tourist destinations, providing valuable insights into spatial patterns, visitor distribution, and potential environmental impacts. The strategic significance of this integration emphasizes its role in fostering a more nuanced understanding of the geographic context in which tourism activities unfold. In conclusion, the seamless database integration with GIS enriches the monitoring system's functionality, enabling a holistic and spatially informed approach to coastal and marine tourism management.



**Figure 9.** Data Integration with GIS Feature of Oracle-Apex

Figure 9 shows the GIS feature integrated with the database using Oracle-apex. The purpose of integrating the database with a Geographic Information System (GIS) is to facilitate decision-making for managers and prioritize programs based on location. The primary goal is to streamline the process of extracting valuable insights from the data by incorporating spatial analysis capabilities through GIS. Supporting this goal, the integration enables managers to make informed decisions by visualizing and understanding the geographical context of tourism-related information. This spatial awareness is crucial for identifying priority areas, allocating resources effectively, and implementing targeted programs to address challenges or opportunities in coastal and marine tourism management. The strategic significance of this integration emphasizes its role in enhancing the precision and effectiveness of decision-making processes. In conclusion, integrating the database with GIS aligns with the broader objective of optimizing managerial capabilities for informed decision-making and strategic prioritization based on geographic considerations.

Optimizing big data and Geographic Information Systems (GIS) can enhance the performance of destination management, particularly in the context of Coastal and Marine Tourism Destinations. The central assertion underscores that integrating big data and GIS creates a robust framework for managing and analyzing large volumes of data from various sources related to coastal and marine tourism. Supporting this claim, big data facilitates data collection and detailed analysis, encompassing visitor behaviors, visitation trends, and environmental impacts. Simultaneously, GIS provides spatial visualization and analysis tools, enabling destination managers to comprehend the geographical context of this information. This combination offers more profound and comprehensive insights, allowing destination management to make more precise and nuanced decisions in enhancing visitor experiences and ensuring destination sustainability. In conclusion, optimizing big data and GIS is a critical strategy for enhancing the performance of destination management, specifically within the Coastal and Marine Tourism sectors.

## 4. CONCLUSION

The implementation of Rapid Application Development (RAD) in the design of the database and integration with GIS using Oracle APEX can optimize the monitoring functions of the coastal and marine tourism destination in Luari Beach by addressing challenges related to visitor data, visitor vehicles, local community participation, and the local environment. The central assertion emphasizes that RAD's iterative and swift development approach



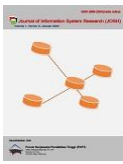
ensures system responsiveness to evolving needs. Supporting this claim, integrating with GIS through Oracle APEX enhances spatial analysis and data visualization, providing a better understanding of coastal and marine tourism dynamics. This solution is essential in tackling complex challenges associated with visitor data, vehicles, community involvement, and environmental sustainability in the Luari Beach destination. In conclusion, implementing RAD with Oracle APEX is recognized as a strategic approach to enhancing the monitoring functions of coastal and marine tourism, creating an efficient and responsive solution to ever-changing dynamics.

## ACKNOWLEDGMENT

Acknowledgments were conveyed to Lembaga Penelitian dan Pengabdian Masyarakat (LPPM), the Tourism Department, Faculty of Business Administration and Communication Sciences, Atma Jaya Catholic University of Indonesia.

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