

Optimizing Boat Rentals and Fishing Activities in Labuhan Amuk, Karangasem, Bali: Key Features for Mobile Applications

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ABSTRACT: This paper investigates the feature requirements of a mobile application aimed at optimizing boat rental and fishing activities while addressing environmental and socio-economic challenges in Labuhan Amuk, Karangasem, Bali. By synthesizing insights from contemporary research, the study identifies core features such as real-time weather updates, GPS navigation, fish stock prediction, resource management, and sustainability reporting. These functionalities are designed to enhance operational efficiency, ensure safety, and promote eco-friendly practices among anglers and fishermen. The proposed features of the application serve as a comprehensive baseline to improve decision-making and foster sustainable fisheries management. The results highlight the potential of integrating these functionalities into a single platform to enhance productivity, ensuring usability and adaptability for diverse fishermen's literacy and needs. Future work will focus on implementation and field testing to validate its impact.

KEYWORDS: feature requirements, key features, boat rental, fishing activities, mobile application

I. INTRODUCTION

Fisheries are a cornerstone of global food security and the economic stability of coastal communities. With millions of livelihoods depending on sustainable fisheries, the sector faces significant challenges, including climate change, overfishing, and economic uncertainties. These challenges necessitate innovative solutions to optimize fishermen's productivity and promote sustainable fishing practices [1]. Mobile applications offer a promising avenue, providing tools for real-time information, resource management, and market access.

This study focuses on the feature requirements and challenges of the investigation of mobile applications to meet the needs of fishermen in Labuhan Amuk, Karangasem, Bali. By integrating technological advancements such as GPS navigation, AI-driven fish stock predictions, and market monitoring systems, the application aims to bridge gaps in current fishing practices [2][3]. Furthermore, it addresses the need for tools to ensure environmental sustainability and compliance with regulatory standards.

Building on existing research, this paper outlines the functional requirements and specifications for such an application, emphasizing features that enhance decision-making, improve safety, and increase profitability for fishermen. The findings of this study aim to guide future implementations and promote the adoption of technology-driven solutions in the fisheries sector.

The optimization of fishermen's productivity through mobile applications has garnered increasing interest in recent

years, with studies highlighting diverse functional requirements and specifications for such tools. This review synthesizes findings from several studies to outline key themes and requirements for mobile applications aimed at improving fishing practices, resource management, and economic outcomes for fishermen.

Numerous studies emphasize the role of technology in enhancing fishermen's access to data and decision-making tools. For instance, [4] discuss how digital platforms can integrate real-time environmental data to assist in locating fish stocks more effectively. Similarly, the integration of GIS and IoT technologies, as explored by [5][6], underscores the importance of spatial and temporal data in optimizing fishing efforts.

On the other hand, mobile applications can significantly influence the socioeconomic status of fishermen by improving market access and reducing inefficiencies. Studies such as [7] highlight how digital marketplaces enable fishermen to bypass intermediaries, ensuring fairer prices for their catches. Other research, including work by [8] and [9], illustrates how technology adoption can mitigate challenges like fluctuating market demand and post-harvest losses.

As noted by [10] and [11], real-time data on weather, sea conditions, fish migration patterns, and potential fishing zones are crucial for safety and efficiency. Meanwhile, in the user interface aspect, research by [12] stresses that applications must be accessible and easy to navigate, considering varying levels of digital literacy among fishermen. Integration with local ecosystems is also crucial.

“Optimizing Boat Rentals and Fishing Activities in Labuhan Amuk, Karangasem, Bali: Key Features for Mobile Applications”

[13] argue for applications tailored to specific geographic and ecological contexts, enabling sustainable resource management. In the connectivity aspect, given the limited connectivity in many fishing areas, applications need robust offline capabilities, as emphasized by [14].

Sustainability is a recurring theme in fisheries technology research. Studies such as those by [15] and [16] discuss how mobile tools can promote sustainable practices through resource monitoring. Additionally, integrating community-driven data and local knowledge, as suggested by [17], enhances stakeholder engagement and compliance with conservation measures.

While mobile applications offer significant benefits, challenges and limitations remain. Financial barriers, resistance to technology adoption, and the need for policy support are highlighted in studies by [1] and [18]. Addressing these challenges and limitations requires collaborative efforts among developers, policymakers, and fishing communities.

The reviewed literature demonstrates that mobile applications hold great potential to optimize fishermen’s productivity and address critical challenges in fisheries by combining technological innovation with user-centric design, providing real-time data, enhancing market access, promoting sustainable practices, and improving the socio-economic conditions of fishing communities. This study combines all those insights with the needs of fishermen in Labuhan Amuk, Karangasem, Bali, so that the proposed features can optimize their boat rental management and fishing activities.

II. METHODOLOGY

The development of feature requirements for a mobile application aimed at optimizing fishermen’s activities involves a multi-stage methodology, incorporating theoretical and empirical insights from relevant studies, stakeholders’ feedback, and practical validation in the fields of fisheries, mobile technology, and productivity gain.

A. Study Area

The study was conducted in Labuhan Amuk, Karangasem, Bali, Indonesia, a coastal area where fishing activities primarily include renting out fishing boats to anglers. There is a traditional fishermen community consisting of 80 members. Unlike most fishermen who typically catch fish, the fishermen in Labuhan Amuk instead rent out their boats to anglers who want to fish around the Labuhan Amuk Bay and its fishing zone, as shown in Figure 1. Fishing activities are usually carried out in two shifts (6 to 8 hours) from morning to afternoon or from night to morning, with the boat owner acting as the driver.

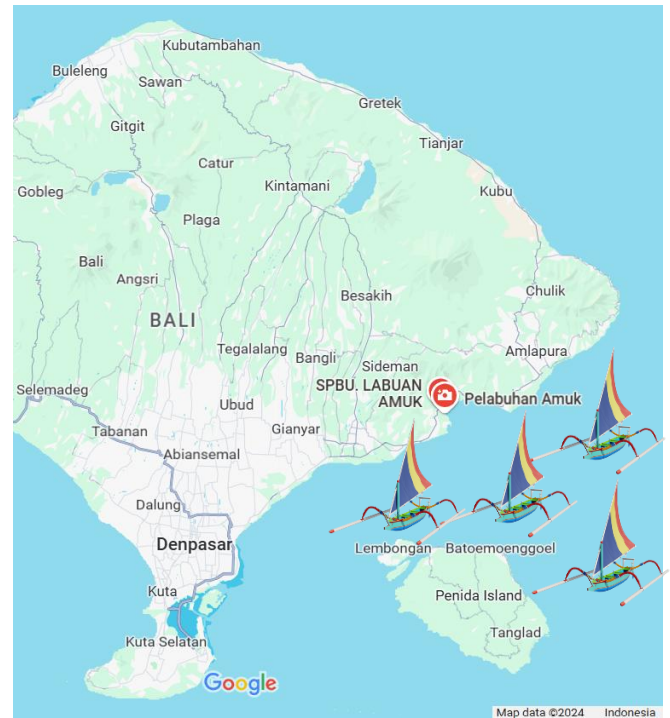


Figure 1. Labuhan Amuk and its Fishing zone



Figure 2. Traditional fishing boats in Labuhan Amuk

B. Literature Review

The first step in developing the mobile application’s functional specifications involved an extensive review of existing research literature, which provided insights into the challenges faced by fishermen and how mobile technologies can assist in addressing these issues. Key references include studies on the role of mobile technology in improving efficiency, tracking, and decision-making processes in fisheries management (e.g., [4], [19], and [20]). Additionally, industry-specific knowledge from studies on optimizing productivity in fisheries (such as [21] and [22]) helped inform the identification of specific requirements for the application.

C. Needs Assessment

To ensure the mobile application’s requirements aligned with real-world needs, a series of stakeholder interviews were conducted with anglers and fishermen in Labuhan Amuk. These interviews, coupled with insights from studies like [23]

and [24], facilitated the identification of key features that would directly address the productivity bottlenecks faced by fishermen, such as navigation, weather forecasting, catch monitoring, rental system, and resource management.

D. Use Case Diagram and Key Features

We propose a use case diagram for defining and communicating the functional requirements of a system. It can demonstrate how various users (actors) work with the system to accomplish particular objectives. End users and other non-technical stakeholders who need to understand the system's function without getting bogged down in technical intricacies may find this to be especially useful. Afterward, the literature review, needs assessment, and use case diagram led to the formulation of key feature requirements for the mobile application. In this case, we identify and categorize features based on their functionalities. This involves identifying and documenting the essential functionalities that the app must have to meet the needs of fishermen.

E. Identification of Challenge and Limitation

Feature analysis is performed to evaluate recurring themes and patterns from the collected information to highlight challenges and limitations as critical bottlenecks in implementing the application. These challenges and limitations can be broadly categorized into some aspects such as technological, economic, and regulatory. Then, the possible solutions to overcome the challenges are also presented.

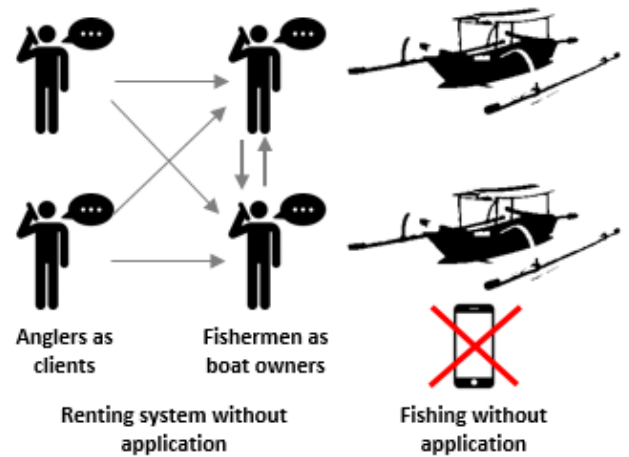


Figure 3. Current fishing boat rental system

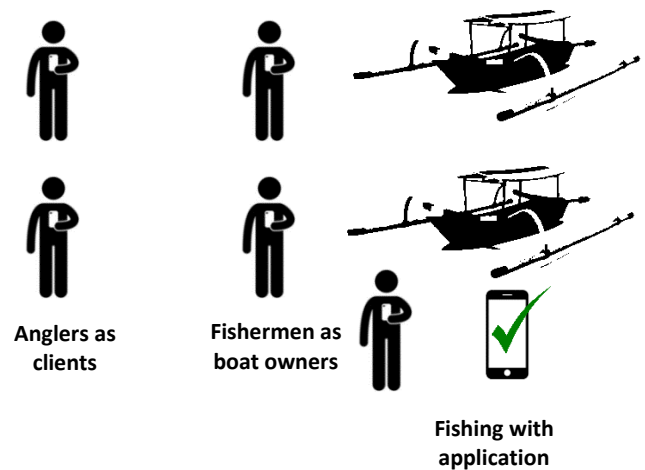


Figure 4. The proposed rental system using apps

III. RESULTS AND DISCUSSION

A. Fishing Boat Rental System

As the fishermen community in Labuhan Amuk relies on renting their boats for fishing, the current fishing boat rental system is shown in Figure 3. In this schema, no supporting application is available yet. If anglers want to rent a boat, they must contact the boat owner via text message or phone call. Furthermore, if the boat is available, a direct transaction will occur between the renter and boat owner, involving the schedule, the fishing spot they want to visit, fishing duration, and rental price. However, if the boat is unavailable, the angler will contact another boat owner, or the current boat owner will assist by reaching out to their colleagues in the community to find another available boat.

Figure 4 illustrates the proposed fishing boat rental system that uses a mobile application, where the boat booking and payment processes are managed through the application by the admin. This will simplify the management and monitoring of boats that have been booked, sailing to the sea, as well as those that are still available. The application is also equipped with features related to anglers at sea. Additionally, it provides real-time updates on boat locations and estimated return times, enhancing safety and convenience for users. This application is expected to facilitate all parties in carrying out their respective roles more efficiently while promoting sustainable fishing practices.

B. Use Case Diagram of the Application

We also propose a use case diagram to illustrate the interaction or relationship between the application users, referred to as actors, and the application itself, as shown in Figure 5. The primary actors include anglers (boat renters), boat owners, and the system administrator. Key use cases involve users registering, browsing available boats, and reserving rentals. The system also offers real-time weather

“Optimizing Boat Rentals and Fishing Activities in Labuhan Amuk, Karangasem, Bali: Key Features for Mobile Applications”

updates, information on fishing hotspots and seasonal suggestions, and ocean conditions, including tides and currents. Boat owners have the option to reply to requests from renters, update availability, and manage listings. The system administrator ensures the platform's smooth operation by maintaining data accuracy and addressing user concerns.

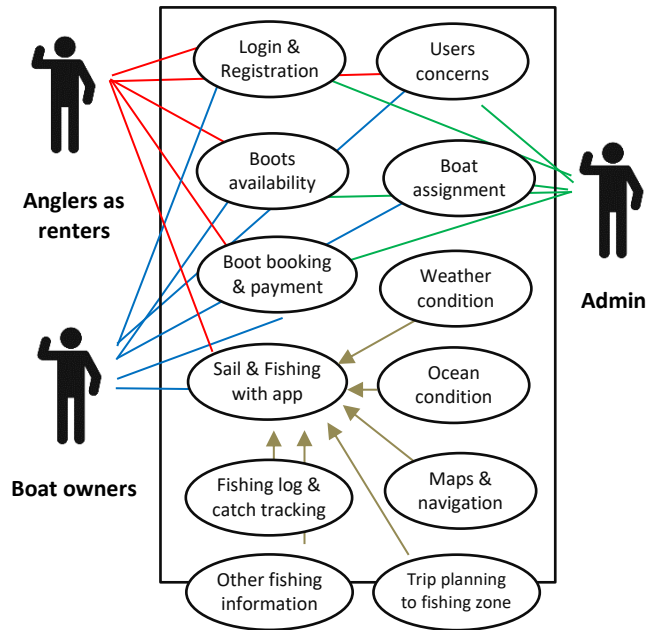


Figure 5. Use case diagram of the proposed mobile app

C. Proposed Key Features

A fisheries-related mobile app should encompass a comprehensive range of group features to address diverse user needs, as shown in Figure 6. These features were designed based on literature review, users’ feedback, and validated through field trials in Labuhan Amuk.

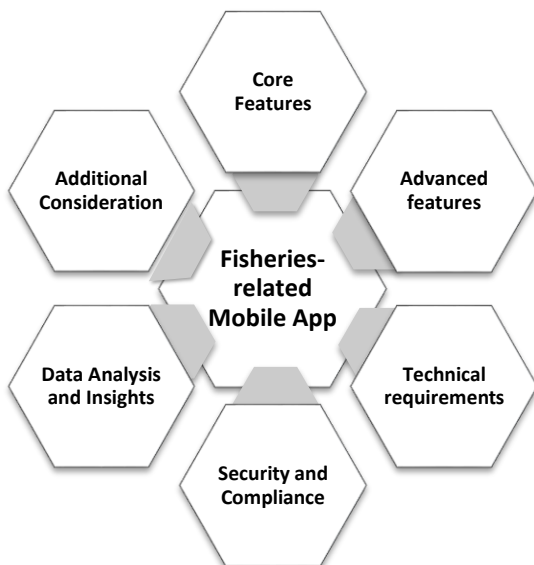


Figure 6. Fisheries-related mobile app features group

Core features could include user profiles, boat rental management, fishing logs, weather updates, and regulatory

compliance tools, ensuring accessibility and functionality for all users. Furthermore, advanced features might include AI-driven fish species recognition, GPS-enabled trip tracking, and real-time data sharing with peers or authorities. Meanwhile, technical requirements should focus on cross-platform compatibility, offline access, and seamless synchronization with IoT devices such as sonar equipment. Security and compliance must prioritize data encryption, secure login protocols, and adherence to local and international fisheries regulations.

Additionally, data analysis and insights tools can leverage predictive analytics to enhance catch statistics and patterns, sustainability practices, and market trends forecasting. Other considerations could include user-friendly design, multilingual support, and integrations with third-party apps or e-commerce platforms for equipment and catch sales.

These features ensure the app meets the practical, regulatory, and technological needs of its users. Details of each group's features are shown in Tables 1 to 6.

Table 1. Core Features

No	Key	Description
1	User Registration	Allow users to create profiles, including license information and vessel details (if applicable).
2	Boat rental management	ensure an efficient experience for both renters and boat owners
3	Fishing Log	Digital logbook for recording catches, including species, size, location, and timestamp.
4	Fishing Regulations	Access to local fishing regulations, permits, and licensing requirements.
5	Fish Identification Guide	Visual database of fish species with descriptions, habitat information, and conservation status.
6	Weather and Ocean Conditions	Real-time weather, tide, and water condition forecasts, as they enabled better decision-making in terms of fishing schedules and locations.
7	Maps and Navigation	Integrated marine charts, GPS navigation, and marking of fishing spots. This can optimize route planning and help fishermen navigate to productive fishing zones.
8	Community Forum	Discussion board for sharing tips, asking questions, and connecting with fellow anglers.

Table 2. Advanced Features

No	Key	Description
1	Predictive Analytics	Fishing forecasts based on historical data, weather patterns, and fish behavior.
2	Catch Tracking	Automatic tracking of catches using GPS and timestamp.
3	Fish Size and Weight	Calculator tool for estimating fish weight based on length and species.
4	Tackle Box Management	Digital inventory management for fishing gear and tackle.
5	Trip Planning	Itinerary builder with weather forecasts, tide tables, and fishing spot suggestions.
6	Safety Features	Emergency alert system, weather alerts, and nearest port locator.
7	Marketplace	Platform for buying/selling fishing gear, booking charters, or finding fishing guides.

Table 3. Technical Requirements

No	Key	Description
1	Cross-Platform Compatibility	Development for iOS, Android, and potentially web applications.
2	Data Storage	Secure, cloud-based storage for user data and fishing logs.
3	API Integration	Integration with weather services, marine data providers, and fisheries management systems.
4	Offline Access	Ability to function without internet connectivity.
5	Push Notifications	Alerts for weather updates, fishing forecasts, and regulatory changes.

Table 4. Security and Compliance

No	Key	Description
1	Data Encryption	Secure data transmission and storage.
2	User Authentication	Robust login and authentication mechanisms.
3	Regulatory Compliance	Adherence to local and international fisheries regulations.
4	Privacy Policy	Clear guidelines on data usage and sharing.

Table 5. Data Analysis and Insights

No	Key	Description
1	Catch Statistics	Personalized statistics on catches, species, and locations.
2	Fishing Patterns	Identification of successful fishing patterns and trends.

3	Water Quality Monitoring	Integration with water quality sensors or APIs.
4	Fish Population Tracking	Aggregated data on fish populations and distribution.

Table 6. Additional Considerations

No	Key	Description
1	User-Friendly Interface	Intuitive design for ease of use.
2	Multilingual Support	Support for multiple languages.
3	Customer Support	In-app support or feedback mechanism.
4	Regular Updates	Continuous updates with new features and regulatory changes.

The proposed features of the mobile application in Tables 1 to 6 have integrated almost all the fisheries-related functionalities and requirements. Many features, from data management and analytics and customer support to technical aspects, are considered. The objectives of this are to improve the standard of living for fishermen in the coastal community, support sustainable fisheries management, boost operational effectiveness, and maximize fishermen's production.

D. Challenges and Limitations

Some challenges and limitation are identified to implement this application, such as:

- Integration challenges arise where many applications struggle to integrate data from diverse sources like government databases, weather monitoring systems, fishing logs, and marketplaces. These issues, which make seamless data sharing challenging, are frequently caused by disparities in data formats, access limitations, and antiquated infrastructure.
- To guarantee accessibility for people with varying degrees of technological literacy, the user interface (UI) design should place a high priority on simplicity and intuitiveness. The ease of navigation and minimal training requirements will significantly enhance user adoption. Clear instructions and a straightforward design are also recognized as essential elements for encouraging engagement within the fisheries sector.
- Connectivity issue where the inconsistency of mobile network coverage in certain remote fishing areas impacted the real-time data synchronization and weather updates. This limitation is particularly evident in more isolated coastal regions, where mobile signals are weak or unavailable. Similar challenges were highlighted in [25], where connectivity issues were

noted as a significant barrier to the widespread adoption of mobile solutions in fisheries.

- Battery consumption of the app during prolonged use, especially when GPS and environmental sensors were continuously active. Although the app was optimized for energy efficiency, feedback suggested that power management improvements were needed for extended fishing trips.
- Regulatory and governance challenges with inconsistent policies. Fisheries management policies vary widely between fishing zones, countries, and regions, complicating the design of universally applicable solutions. These inconsistencies often lead to difficulties in enforcing regulations and monitoring compliance on a global scale.
- Economic constraints where funding is limited. Small-scale fisheries often operate on tight budgets, making it hard to adopt or maintain advanced technologies. Limited access to financial resources also restricts their ability to invest in training and capacity-building initiatives. Furthermore, fluctuating market prices for fish and unstable income streams exacerbate these challenges, leaving little room for long-term planning or innovation.

To overcome these challenges, some efforts must be done to address these limitations include implementing standardized protocols to ensure compatibility, technological innovations to developing affordable, user-friendly tools that work offline or in low-connectivity environments, policy integration to align fisheries applications with local, national, and international policies, community engagement to involve local fishing communities in the design and implementation of applications to ensure cultural relevance and usability, and partnerships to collaborate with governments, NGOs, and private sectors to pool resources and share best practices. Additionally, continuous monitoring and evaluation are necessary to assess the effectiveness of these solutions.

IV. CONCLUSION

By incorporating necessary functions like weather updates, GPS navigation, and fishing log management, the suggested smartphone application provides a creative way to maximize fishing operations in Labuhan Amuk, Karangasem, Bali. This study emphasizes how such technology could help fishermen with issues like increasing productivity, guaranteeing safety, and fostering sustainability. By combining insights from literature, stakeholder feedback, and practical validation, the application is designed to meet the diverse needs of the fishing community while catering to the many demands of the fishing community. Future research should concentrate on improving energy efficiency, resolving connectivity problems, and carrying out comprehensive field tests to hone and confirm the application's influence on fishing methods and socioeconomic results.

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