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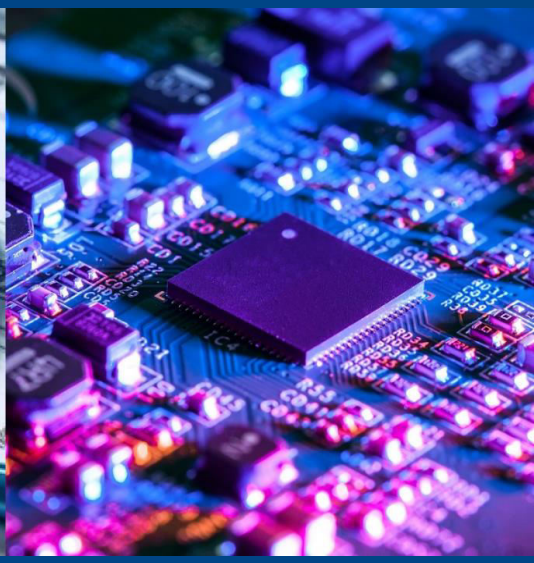

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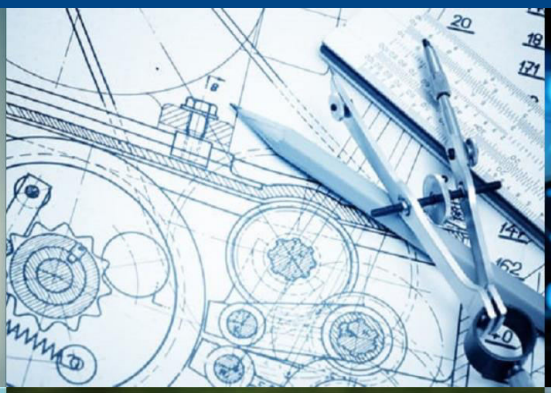

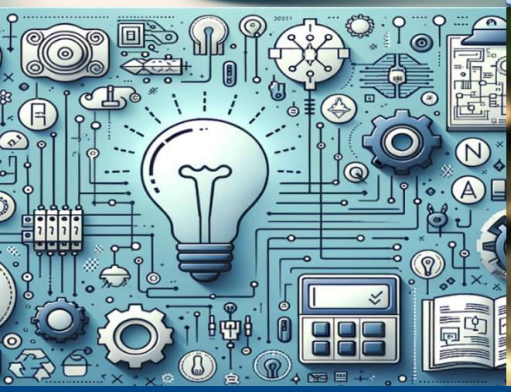

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LiSEAnsyado: A Cross-Platform Fishing Gear and Vessel Registration and Licensing System in Cantilan, Surigao del Sur

Lea J. Medrano[1], Roselle O. Lopio[1], Fae Mylene M. Etchon, Ph.D.[2], Sharon A. Bucalon, MIT[3]

Undergraduate Student, Department of Computer Studies, North Eastern Mindanao State University - Cantilan Campus, Cantilan, Surigao del Sur, Philippines[1]

Assistant Professor IV, Department of Computer Studies, North Eastern Mindanao State University - Cantilan Campus, Cantilan, Surigao del Sur, Philippines[2]

Instructor III, Department of Computer Studies, North Eastern Mindanao State University - Cantilan Campus, Cantilan, Surigao del Sur, Philippines[3]

ABSTRACT: The Municipality of Cantilan, Surigao del Sur, relies on a traditional, manual Municipal Fisheries Registration and Licensing (MFRL) system, resulting in low compliance and persistent challenges in combating Illegal, Unreported, and Unregulated (IUU) fishing. This study developed LiSEAnsyado, a cross-platform system built with Next.js and Firebase to digitize the registration process. Key features include online registration, automated QR code generation, and real-time application tracking. Evaluation based on ISO/IEC 25010 standards yielded an overall average score of 3.6, interpreted as "Very Highly Acceptable (VHA)". The system provides a centralized database that enhances efficiency, promotes transparency, and strengthens compliance monitoring.

KEYWORDS: LiSEAnsyado, Fisheries Management, Registration and Licensing, IUU Fishing, ISO/IEC 25010, QR Code.

I. INTRODUCTION

The Municipality of Cantilan, Surigao del Sur, is a coastal community deeply rooted in the blue economy, where fishing serves as the primary source of food security and livelihood for thousands of residents. However, as the maritime industry expands, the governance of these resources faces a critical bottleneck: the reliance on outdated, manual administrative processes. The current Municipal Fisheries Registration and Licensing (MFRL) system is characterized by physical logbooks, manual paperwork, and decentralized records, which are not only prone to human error but also act as a deterrent for local fisherfolk due to the time and logistical effort required to achieve compliance.

National mandates, such as the Philippine Fisheries Code (RA 8550 as amended by RA 10654), require all fishing gear and vessels to be registered to combat Illegal, Unreported, and Unregulated (IUU) fishing. Despite these laws, studies indicate that 27-40% of the domestic catch in recent years can be traced back to illegal activities, including the use of unregistered vessels and prohibited gear [1]. This lack of transparency undermines the sustainability of marine ecosystems and results in significant economic leakage for the local government.

The primary challenge lies in the accessibility of the registration process. Many fisherfolk reside in remote coastal areas with limited access to municipal centers. The LiSEAnsyado system was conceptualized to bridge this gap by providing a cross-platform solution, accessible via both web and mobile applications. By utilizing cloud-based storage (Firebase) and automated QR code generation, the system seeks to modernize the registration workflow, providing real-time data synchronization between the field and the central office. This study aims to replace the high-friction manual system with a low-friction digital environment that enhances traceability, improves government service delivery, and fosters a culture of legal compliance among the fishing community.

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II. LITERATURE REVIEW

A critical assessment of the work done so far on fisheries management and registration systems has been conducted to show how the current study relates to existing frameworks. Numerous local government units are currently migrating to digital governance due to the increasing complexity of monitoring maritime assets. For small municipalities like Cantilan, the security of registration data and the accessibility of licensing services are primary concerns. The best alternative for these units is to transition from manual, paper-based systems to centralized digital platforms that provide full-package services, including automated verification and real-time tracking. Researchers have presented various findings on the real-world scenarios of Illegal, Unreported, and Unregulated (IUU) fishing, but it was found that despite significant research, only a fraction of technical work has directly contributed to the ease of use for local fisherfolk. While the Philippine Fisheries Code has existed for decades, digital integration is not yet fully realized at the municipal level, leaving a huge room for improvement in cross-platform registration methods.

Lowe, J., Souter, D., Muallil, R., & Batongbacal, J. [1] discussed Transparency in Philippine Fisheries Governance in 2023. The authors examined how the lack of transparency in registration leads to significant economic loss. They highlighted that 27-40% of the domestic catch in 2019 was linked to illegal activities, often involving unregistered vessels. Their study emphasized that manual registration acts as a barrier, as fishers find the physical paperwork and travel to municipal offices burdensome. This lack of a streamlined process contributes directly to the data gaps that allow IUU fishing to persist. In this paper, the authors highlight the governance gap caused by registration hurdles. The LiSEAnsyado system addresses this by providing an online submission module, allowing fisherfolk to apply for licenses without the need for constant physical travel, thereby increasing the transparency and compliance rates discussed by Lowe et al.

Ogoc et al. [2] conducted an assessment regarding IUU fishing in Mabuhay, Zamboanga Sibugay in 2025. The researchers identified that low registration and licensing rates are primary drivers for illegal fishing practices in coastal municipalities. They argued that without a robust way to identify which gears and vessels are authorized to be in specific waters, enforcement becomes nearly impossible. Their findings suggest that registration must be made more "user-friendly" to encourage the community to participate in legal frameworks. The proposed method in LiSEAnsyado focuses on user accessibility through a cross-platform (Mobile and Web) approach and multilingual support. By addressing the "user-friendly" requirement identified by Ogoc et al., this research provides the technical tool necessary to solve the low-compliance issues identified in their assessment.

Ohlman et al. [3] explored the Challenges of Centralized, Analog Catch-Recording Methods in 2022. The authors discussed how traditional pen-and-paper systems are prone to damage, loss, and human error. Furthermore, they noted that in rural areas, the lack of immediate digital feedback prevents fisherfolk from seeing the benefits of registration. They proposed that any future system must be able to function across various devices to accommodate the varying technological access of users in coastal areas. LiSEAnsyado utilizes a cloud-based backend (Firebase) to move away from the analog recording methods criticized by Ohlman. By integrating QR code technology, the system provides the "immediate digital feedback" mentioned, allowing authorities to verify assets instantly via a smartphone, which bridges the gap between manual records and modern enforcement.

Tolentino-Zondervan and Zondervan [4] proposed Sustainable Fishery Management Trends in Philippine Fisheries in 2022. The authors discussed the necessity of moving toward digital governance to ensure the long-term sustainability of marine resources. They argued that for a system to be accepted, it must minimize the computational and logistical overhead for both the government and the end-user. Their work focused on the "acceptability" of new technologies in traditional sectors like fishing. The evaluation of LiSEAnsyado using the ISO/IEC 25010 standard directly addresses the "acceptability" concerns raised here. By achieving a "Very Highly Acceptable" rating, this research proves that digital registration systems can be successfully integrated into traditional fishing communities if they are designed with reliability and usability in mind.

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Thamarai, S. G., et al. [5] proposed Comprehensive Security Systems for Fishermen in 2024. Their research focused on the integration of tracking technologies and security protocols to protect fishermen and their assets at sea. They emphasized that a digital identity for every vessel is the first step toward effective maritime search and rescue and asset protection. The work of Thamarai et al. highlights the safety benefits of registration. By assigning a unique digital identity (QR code) to each vessel, LiSEAnsyado provides the foundational data needed for the security and tracking frameworks discussed in their 2024 study.

Table 1. Summary of Relevant Literatures

No.	Paper Title	Author Name	Key Points	Remark
1	Transparency in Philippine Fisheries Governance	Lowe et al., 2023	Identified that 27-40% of catch is illegal due to registration gaps [1].	Highlights the need for transparent, digital enforcement.
2	Assessment regarding IUU fishing	Ogoc et al., 2025	Linked low registration rates to increased IUU fishing activities [2].	Justifies the need for a user-friendly registration system.
3	Challenges of Analog Recording	Ohlman et al., 2022	Analog methods are prone to error and lack immediate feedback [3].	Supports the move to a cross-platform digital database.
4	Sustainable fishery management trends	Tolentino-Zondervan, 2022	Sustainability depends on the digital transition of governance [4].	Focuses on the acceptability of tech in traditional sectors.
5	Comprehensive Security for Fishermen	Thamarai et al., 2024	Discussed security systems and tracking for maritime assets [5].	Emphasizes the role of asset tracking in fisherman safety.

In conclusion, the literature review confirms that while the legal framework for fisheries exists, the technical implementation at the municipal level remains the weakest link. LiSEAnsyado fills this gap by providing a high-reliability, low-friction digital platform that aligns with international trends in sustainable maritime resource management.

III. METHODOLOGY

Research Design

This study employed a Descriptive Developmental Research Design following the Agile Model of the Software Development Life Cycle (SDLC). No experimental treatment was introduced to the participants; instead, the study focused on the iterative development of a functional system and the analysis of its quality through standardized metrics in its natural administrative context.

Instrument

The system was evaluated using a survey instrument based on the ISO/IEC 25010 Software Quality Model. The questionnaire utilized a four-point Likert scale (ranging from 1 = Not Acceptable to 4 = Very Highly Acceptable) to measure eight key dimensions: Functional Suitability, Performance Efficiency, Usability, Compatibility, Reliability, Security, Maintainability, and Portability. Items were structured to assess the system's effectiveness in automating the registration and licensing process for the municipality.

Data Collection and Participants

The survey was administered to a total of 50 participants in the Municipality of Cantilan, Surigao del Sur. This included 30 local fisherfolk (end-users), 10 staff members from the Department of Agriculture (administrators), and 10 IT practitioners (technical experts). Participation was voluntary, and the system was demonstrated to participants prior to data collection to ensure an informed evaluation of its cross-platform features.

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Data Analysis

The quantitative data gathered from the evaluation were analyzed using the following statistical treatments:

1. Weighted Mean: To determine the average rating for each ISO/IEC 25010 characteristic.
2. Verbal Interpretation: Scores were mapped to qualitative descriptors (3.26 – 4.00 = "Very Highly Acceptable", 2.51 – 3.25 = "Highly Acceptable", 1.76 – 2.50 = "Acceptable, 1.00 – 1.75 = "Not Acceptable").
3. Cross-Platform Performance Testing: Analysis of system uptime and response times across web and mobile interfaces to validate the "Performance Efficiency" and "Reliability" constructs.
4. Security Validation: Assessment of the Firebase Authentication and Firestore security rules to ensure data integrity and provenance for legal evidence.

IV. RESULTS AND DISCUSSION

System Features

LiSEAnsyado successfully digitized the registration process. Key modules include the Fisherfolk Module for online application submission and status tracking, the Admin Module for inspection scheduling, document verification, and license issuance, and QR Generation for automated unique identifiers for rapid field inspection.

Performance Evaluation

The system achieved a "Very Highly Acceptable" (VHA) rating across all metrics. The overall average score was 3.6. The highest characteristic was Reliability at 3.875, while the lowest characteristic was Performance Efficiency at 3.23.

Table 2. Performance Evaluation System Tabulation

Table	Quality Characteristic	Mean	Verbal Interpretation
1	Functional Suitability	3.28	Very Highly Acceptable (VHA)
2	Performance Efficiency	3.23	Highly Acceptable (HA)
3	Usability	3.36	Very Highly Acceptable (VHA)
4	Compatibility	3.75	Very Highly Acceptable (VHA)
5	Reliability	3.875	Very Highly Acceptable (VHA)
6	Security	3.76	Very Highly Acceptable (VHA)
7	Maintainability	3.78	Very Highly Acceptable (VHA)
8	Portability	3.73	Very Highly Acceptable (VHA)
	Over - All Mean	**3.6**	**Very Highly Acceptable (VHA)**

V. CONCLUSION

The development and implementation of the LiSEAnsyado system represent a significant milestone in the digital transformation of municipal governance in Cantilan. Through this study, it was demonstrated that transitioning from a manual, paper-based registry to a centralized, cloud-based platform effectively mitigates the long-standing issues of data fragmentation and administrative delays. The core features of the system (including automated QR code verification, digital provenance, and cross-platform accessibility) address the specific logistical barriers faced by coastal communities.

The high evaluation scores based on the ISO/IEC 25010 standard underscore the system's readiness for real-world deployment. The "Very Highly Acceptable" rating from both administrators and end-users proves that even in traditional sectors like fisheries, there is a strong appetite for technological solutions that simplify legal compliance and enhance data security. Ultimately, LiSEAnsyado does more than just digitize records; it provides the Department of

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Agriculture with a powerful tool to monitor maritime assets in real time, thereby strengthening the municipality's ability to combat IUU fishing.

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