Research Article

The Design and Development of CATCHFISH System: A Collaborative ICT-Based Tool for an Optimize Fishing Repository and Catch Efficiency

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ARTICLE INFO	ABSTRACT
	The fishing industry is vital to the global economy, supporting food security and livelihoods, particularly in coastal and island nations. However, the sector faces severe challenges leading to declining fish stocks and ecosystem degradation. In the Philippines, Lagonoy Gulf is a critical marine area with rich biodiversity, essential for local communities who rely on fishing for their income and sustenance. Yet, the Gulf faces significant challenges that threaten this vital resource. To address these challenges, there has been a growing recognition of the need for more sustainable fishing practices. Hence, the CATCHFISH System—Collaborative Access to Tracking Community Handling of Fisheries Information, Science, and Harvest—was developed. This innovative digital repository aims to enhance fisheries management by providing a centralized platform for real-time data collection, analysis, and collaboration among stakeholders. The system supports sustainable practices by optimizing fishing operations, and minimizing environmental impacts. The system's functionalities are integral to its main objective. It enables users to create and manage content efficiently, retrieve vital information, and perform detailed descriptive analytics. Specifically, the system facilitates the creation and maintenance of data related to fisher folks' profiles, fishing gear, vessel, and fish catches. It also allows users to retrieve this information, with data categorized by various parameter. Descriptive analytics further enrich the user experience by providing in-depth reports on fishery data, which are segmented similarly for ease of analysis. The system was rigorously evaluated, achieving high usability, high acceptability and high reliability ratings of 96.30% 95.07% and 93.83%, respectively. These ratings reflect its effectiveness in meeting user needs and performing consistently. The CATCHFISH System may significantly improve fishing practices by delivering real-time data and fostering collaboration among various stakeholders. By offering comprehensive insights and facilitating effective communication, it supports sustainable development practices that ensure the long-term viability of marine resources. This collaborative approach not only optimizes fishing operations but also enhances the management and preservation of marine ecosystems, thereby promoting a more responsible and resilient fishing industry for future generations. **Keywords:** *Catchfish System, Lagonoy Gulf, Fisher Folks, Software Development, Digital Repository.*

INTRODUCTION

The fishing industry plays a critical role in the global economy, providing food, employment, and livelihoods for millions of people worldwide. It is especially crucial in coastal and island nations, where fishing is a primary source of income, and fishing is a significant economic activity. However, the industry faces numerous challenges that threaten its sustainability. Overfishing, illegal and unregulated fishing practices, habitat destruction, and the impacts of climate change have led to declining fish stocks and degradation of marine ecosystems. These challenges not only jeopardize the future of the fishing industry but also pose a risk to food security and the livelihoods of millions.

In the Philippines, Lagonoy Gulf is one of the crucial marine area with a rich array of fish species and vibrant ecosystems. Serving as a vital source of livelihood and food for local communities, the Gulf supports both artisanal and commercial fishing activities. Local fishermen use traditional methods to catch species like sardines and tuna, while commercial operations target high-value fish for broader markets. However, the Gulf faces significant challenges. Overfishing and destructive fishing practices threaten the sustainability of fish stocks, particularly larger predatory species. Environmental issues such as pollution, habitat destruction, and climate change further exacerbate the decline in marine resources. Fishing activities have a profound socio-economic impact on local communities. One of the roles of the government is the provision of information to increase efficiency and improve the performance of the economy (Just and Zilberman, n.d.). While fishing supports many families and local economies, declining fish stocks and environmental pressures jeopardize their livelihoods and income. In response to these challenges, there has been a growing recognition of the need for more sustainable fishing practices. Governments, NGOs, and international organizations have implemented various measures, such as establishing marine protected areas, enforcing fishing strategies, and promoting the Ecosystem Approach to Fisheries (EAF). Despite these efforts, significant gaps remain in effectively managing fishery resources, particularly in data collection, monitoring.

Information and Communication Technology (ICT) has the potential to transform the fishing industry by addressing many of the challenges it faces. The development of information systems according to Strauss, L. (2022) encompass the tools used to collect, manage, and analyze data. Similarly, Markgraf (2019) emphasized in his article that information system is important by processing the data from the user inputs and generating information that is useful for an informed decision. Kittinger et al. (2017) on the other hand, discuss how ICT can enhance fisheries compliance and monitoring. These tools can facilitate real-time data collection, enhance communication among stakeholders, and support data-driven decision-making processes. Bostock et al. (2016) highlight how these digital tools can create transparent, accessible data repositories that improve the accuracy and reliability of fishery data. For instance, mobile applications can enable fishermen to report their catches instantly. Moreover, the World Bank (2017) emphasizes ICT's potential to drive sustainable fisheries by enhancing data collection, transparency, and collaboration across stakeholders. ICT tools and information systems improve the efficiency of data handling, which is key to reducing overfishing and ensuring compliance with sustainability goals. Similarly, the FAO (2018) stresses the need for collaborative platforms in fisheries management, noting that CATCHFISH aligns with this approach by involving local communities in tracking fishing activities. By promoting shared responsibility in resource management, the platform supports local and regional management strategies, contributing to long-term sustainability.

The global significance of sustainable fisheries is further underscored in the United Nations Sustainable Development Goals (SDGs) Report (2019), which identifies sustainable fisheries as a key element of SDG 14 (Life Below Water). ICT innovations support these goals by providing tools to monitor fishing activities and manage resources efficiently. The platform contributes to global objectives for sustainability, economic resilience, and environmental stewardship in the fishing industry. At the local level, Jentoft and Chuenpagdee (2015) explore community-based fisheries management (CBFM), emphasizing the importance of local stewardship of marine resources. An ICT based tool that supports this model by empowering communities to manage their fisheries more effectively through digital tools that enhance data management and participation is a requirement. By fostering a collaborative environment, these tools can help balance traditional knowledge with scientific data, promoting both ecological sustainability and community livelihoods.

The rise of smart fisheries technology, as described by Froese and Pauly (2020), highlights the potential of real-time tracking systems, automated data collection, and collaborative platforms. These tools optimize fishing operations and ensure compliance with sustainable practices by enhancing the accuracy of fisheries data and allowing for real-time decision-making. Furthermore, Sheppard et al. (2021) focus on the role of big data in fisheries and marine conservation, with platforms like CATCHFISH collecting vast amounts of data on fish catches and fishing patterns. This data-driven approach enables more informed policymaking, helping to address challenges such as overfishing, illegal fishing, and biodiversity loss.

Despite the advantages and availability of various ICT tools, the fishing industry has yet to fully leverage the potential of these technologies. Existing solutions often lack integration and fail to provide a comprehensive approach to fisheries management. Building on the need for sustainable approaches, Pikitch et al. (2014) advocate for ecosystem-based fisheries management (EBFM), where ICT platforms can aggregate data on fish populations, habitats, and

human activities to provide a comprehensive view of ecosystem interactions. This holistic management approach balances ecological, social, and economic objectives, contributing to the more sustainable use of marine resources. Similarly, Hilborn et al. (2015) underscore the importance of data repositories in enhancing fisheries science enabling for an accurate recording of fish catch data, and community fishing patterns, leading to improved stock assessments and better regulatory measures. The development and adaptation of a collaborative platform that brings together all stakeholders—fishermen, local government units, Bureau of Fisheries and Aquatic Resources and NGOs— is now an indispensable requirement to share information, optimize fishing activities, and ensure the sustainable use of marine resources.

It is in this context, the CATCHFISH System—*Collaborative Access to Tracking Community Handling of Fisheries Information, Science, and Harvest*—was developed, evaluated, and implemented as an innovative digital repository designed to accurately capture and record data related to the fisheries community, fishing resources, and fish catch along the coastline of Lagonoy Gulf. This collaborative platform optimized fishing operations by providing a centralized repository for fishing data, improving catch efficiency, and promoting sustainable practices, where all relevant information is stored and easily accessible. By centralizing this information, the system enables more efficient data management and supports data-driven decision-making. And by providing accurate and up-to-date information, it also allows fishermen to make informed decisions about where and when to fish, reducing bycatch and minimizing the environmental impact of their activities. This emphasis on collaboration fosters an effective fisheries management that requires the active participation of all stakeholders thus enabling fishermen to share information on fish catch, fishing locations, species availability, and environmental conditions so that regulators can use this information to monitor fishing activities, enforce regulations, and ensure compliance.

At the heart of this system is the commitment to promoting sustainable use and development of marine resources. By providing tools for monitoring, data analysis, and decision-making, it empowers the fishermen to adopt practices that are environmentally responsible and economically viable. Moreover, the system aligns with several global and local initiatives aimed at promoting sustainable fisheries management. Notably, it supports the United Nations Sustainable Development Goals (SDGs), particularly Goal 14, which focuses on conserving and sustainably using the oceans, seas, and marine resources. The development and implementation of this system contributes to this goal by providing a platform that promotes responsible fishing practices, enhances the management of fishery resources, and reduces the environmental impact of fishing activities.

The CATCHFISH System represents a significant step forward in the use of ICT to address the challenges facing the fishing industry. By providing a collaborative platform that optimizes fishing operations and promotes sustainable practices, it has the potential to transform the way fisheries are managed. The platform aligns with global and local goals for sustainable development, offering economic, environmental, and social benefits. As the fishing industry continues to evolve, innovative solutions like CATCHFISH System is essential in ensuring the sustainable use and development of marine resources for future generations.

METHODOLOGY

Research Design

This project employs both descriptive and developmental research methodologies to achieve its objectives. The descriptive method is used to gather and document critical data regarding fisheries communities, fishing resources, and fish catch recording. By systematically compiling these resources, the project aims to provide a comprehensive understanding of the current state of fisheries management, including the socio-economic conditions of the communities involved and the patterns of fish catch. This data collection forms the foundational basis for informed decision-making, ensuring that the project addresses relevant and timely issues within the fisheries sector.

Similarly, the project follows a developmental approach, emphasizing the iterative creation and refinement of the CATCHFISH system. This approach is essential, as it not only facilitates the development of the software but also ensures adaptability and responsiveness to real-world needs. By employing an iterative model of software development, the project will progress through phases such as requirements analysis, system design, coding and implementation, testing, and deployment and operation. Each phase builds upon the previous one, allowing for continuous improvement and optimization of the system. The combination of these methodologies ensures that the

CATCHFISH tool is both data-driven and technically robust, addressing the needs of sustainable fisheries management."

Requirements Analysis

This phase in systems design and development involves data gathering, structured interviews, recording, and identifying data and information the system should accommodate. These include categorizing information related to CATCHFISH and developing functionalities the system will provide. The required tools, technologies, and methods relative to the design and development of CATCHFISH will also evidently be deliberated in this phase.

This phase of systems design and development focuses on the comprehensive process of data gathering, structured interviews, and documentation, aimed at identifying and defining the specific data and information the system must accommodate. A critical aspect of this stage is the categorization of information relevant to the CATCHFISH system, which ensures that the system effectively addresses the unique needs of fisheries communities and fish catch management. Additionally, this phase involves determining the core functionalities that CATCHFISH will offer, which may include features for tracking, reporting, and analyzing fish catch data, as well as tools for resource management.

Moreover, this stage is pivotal for evaluating and selecting the appropriate tools, technologies, and methodologies that will be utilized during the design and development of the system. This includes decisions on software frameworks, development platforms, database management systems, and other technical components that will underpin the system's performance and scalability. Through a detailed deliberation process, the project team ensures that the chosen technologies align with the project's goals, ensuring the efficient and effective implementation of CATCHFISH. Ultimately, this phase lays the groundwork for building a system that is both functionally robust and adaptable to the evolving needs of sustainable fisheries management.

System Design

CATCHFISH was designed to be a framework for information sharing and management. The repository will be provided with information from various sources.
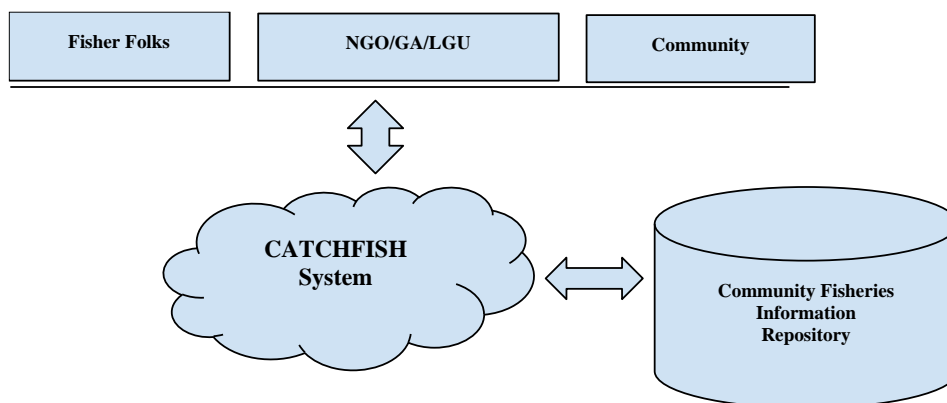

Figure 1. CATCHFISH System Logical Framework

The CATCHFISH system framework is designed to integrate key external entities, namely fisher folks and community and NGOs/GA (Non-Governmental Organizations/Government Agencies), to enhance fisheries management. Fisher folks, who are directly involved in fishing activities, contribute crucial data on their catches, fishing practices, and environmental conditions. Community and NGOs/GA play a supportive role by providing additional data and insights relevant to the fisheries sector. This data is submitted to the CATCHFISH system, where it undergoes processing to ensure its accuracy and relevance. Once processed, the information is stored in a centralized Community Fisheries Information Repository. This repository serves as a comprehensive database, facilitating better data management and informed decision-making. The systematic approach of the CATCHFISH system not only improves the reliability of the data but also promotes community engagement and collaboration among all stakeholders, ultimately supporting sustainable fisheries management and resource allocation.

Coding and Implementation

The requirements and functionalities identified during the analysis phase were translated into functional modules for the CATCHFISH system. Various web technologies were employed to develop the system, with PHP, JavaScript, and HTML utilized for frontend development. These technologies were selected to create a dynamic and user-friendly interface, enhancing the overall user experience. For the backend, MySQL was used to manage and store data efficiently, ensuring the system could handle large volumes of information effectively. This combination of technologies was carefully chosen to ensure that the CATCHFISH system was robust, scalable, and capable of delivering the required functionalities. The development process integrated these technologies seamlessly to build a cohesive and functional information system, aligning with the objectives outlined in the requirements analysis phase and addressing the needs of its users effectively.

Testing

During this phase, the focus was on conducting tests with potential users of the CATCHFISH system to gather valuable feedback and inputs aimed at enhancing its functionality. Comprehensive user insights were collected through structured interviews and surveys, which provided detailed information on user experiences and system performance. This feedback was crucial for identifying areas needing improvement and refining the system's features. Simultaneously, developers carried out thorough evaluations and unit testing of various system components. This included an assessment of the content creation pages, knowledge retrieval pages, social network services pages, and other viewable elements. The goal was to ensure that each component functioned correctly and integrated seamlessly with other parts of the system. This dual approach—combining user feedback with technical assessments—ensured a holistic evaluation of the system. The integration of insights from potential users with rigorous technical testing helped in addressing any issues and optimizing the system's performance. As a result, the system was refined to enhance overall user experience, ensuring that it met the needs and expectations of its users effectively.

Deployment and Operation

Upon the deployment of the CATCHFISH system, various user roles were established to ensure the integrity of the information managed by the system. System administrators, content creators, and content moderators were designated as key entities responsible for contributing to and managing the data repository. System administrators oversaw the overall operation and security, content creators added and updated information, and content moderators ensured the accuracy and appropriateness of the content. Regular users, on the other hand, were restricted to viewing and accessing the information available within the system, without the ability to modify or contribute to the data. This structured approach was implemented to maintain a high level of data integrity and to ensure that the system operated efficiently while serving its intended purpose effectively.

Respondents

Key informants in this study are the fisher folks in coastline along Lagonoy Gulf, concerned offices from the local government units in Camarines Sur (Tigaon, Sagnay, and San Jose) and the local government unit of Catanduanes, WWF personnel, BFAR, and the researchers and other experts in the field.

RESULTS AND DISCUSSIONS

The initiative of the researchers to design and develop the CATCHFISH system was viewed as an indispensable gesture to support the efforts of the government and other non-governmental organization for the sustainable use and development of marine resources particularly in the coastline of Lagonoy Gulf, where it serves as a vital source of livelihood and food for local communities. CATCHFISH system was designed to address the gaps in the current ICT tools used in the fishing industry. This collaborative platform was developed to optimize fishing operations by establishing a centralized repository for fishing data, thus improving catch efficiency and promote sustainable practices. By consolidating all relevant information into a single, easily accessible location, the system facilitated more efficient data management and supported informed decision-making.

One of the system's core function is by allowing fisher folks and other system users to access accurate and up-to-date information, enabling them to make well-informed decisions regarding fisher folks profile, fish catch, fishing gears and other fisheries information relevant for decision making. This capability significantly contributed to reducing fishing irregularities impact of their activities.

The centralization of data ensured that all stakeholders had access to a comprehensive and unified source of information, streamlining the decision-making process and enhancing overall operational efficiency. The implementation of this platform marked a significant advancement in how fishing data was managed and utilized, reinforcing the commitment to sustainable fishing practices and the responsible management of marine resources.

During the design and development of CATCHFISH system, the researchers developed an innovative software development paradigm, the CATSYS Software Development Paradigm. Figure 2 presents the CATSYS Software Development Paradigm.
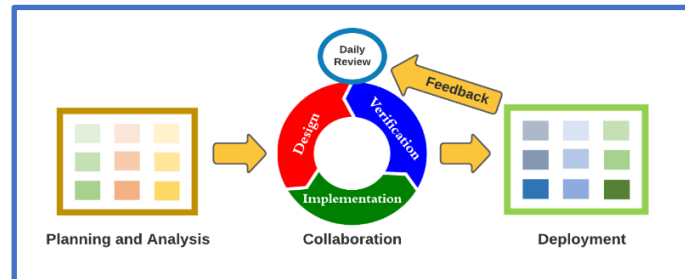

Figure 2. CATSYS Software Development Paradigm

The development of the CATCHFISH System adhered meticulously to a set of software development procedures established by the researchers. This approach represented a systematic integration of methods and techniques derived from the researchers' own software development practices, with elements drawn from Agile methodologies. The procedures were designed to ensure strict compliance with ISO/IEC 25010 standards, which guarantee that the software delivered would meet criteria for functionality, efficiency, compatibility, maintainability, reliability, portability, security, and usability.

Throughout the development process, an evaluation team was engaged to rigorously assess the system's interface and verify its adherence to recognized software quality principles. This evaluation was crucial in identifying any usability issues and problems related to the development processes and user design. The feedback from this evaluation informed ongoing refinements, ensuring that the final product not only met but exceeded the expected standards of quality.

The integration of these practices ensured that the CATCHFISH System was developed with a focus on delivering a high-quality, user-centered solution. The systematic approach and adherence to established standards played a key role in achieving a reliable and effective system that met the needs of its target users in a timely manner.

Planning and Analysis

The project commenced with a thorough planning and analysis phase, which was crucial for laying the foundation of its development. This phase involved a comprehensive feasibility discussion that encompassed the project's objectives, vision, and available resources. The requirements for the project were meticulously defined, and the return on investment (ROI) was rigorously justified to ensure the project's viability and alignment with its goals.

During this initial phase, the researchers undertook an extensive data gathering process. This involved conducting structured interviews, recording valuable information, and identifying the specific data that the system needed to accommodate. The researchers focused on categorizing relevant information related to the CATCHFISH system, which was essential for determining the scope and functionality of the project.

Additionally, the researchers developed a detailed understanding of the functionalities that the system would offer. This involved defining and designing the features necessary to meet the needs of its users and ensure effective performance. The planning and analysis phase was instrumental in shaping the project's direction, setting clear expectations, and establishing a solid foundation for subsequent development activities. By carefully defining requirements and justifying the ROI, the researchers ensured that the project was well-positioned for success and capable of delivering meaningful and valuable outcomes.

Collaboration

In the collaboration phase, the first iteration of the software project commenced, with the objective of delivering a functional version within the specified timeline. During this phase, the CATCHFISH System was meticulously designed to serve as a comprehensive framework for information sharing and management. This design encompassed various essential elements, including user interfaces, data processing modules, and integration capabilities to ensure a cohesive and efficient system.

The system was envisioned to facilitate the integration of data from diverse sources, including local fisher folks, community, NGOs, and governmental agencies, ensuring a robust and dynamic repository. By incorporating these elements, the CATCHFISH System aimed to enhance the accuracy and relevance of the information gathered. This phase also involved establishing protocols for data input, verification, and storage, laying the groundwork for a reliable and user-friendly platform.

The design and development efforts during this period focused on creating a structure that would support seamless data flow and management, setting the stage for effective decision-making and resource allocation. The collaboration phase was instrumental in shaping the foundation of the CATCHFISH System, preparing it for subsequent testing and implementation phases to achieve its envisioned impact.
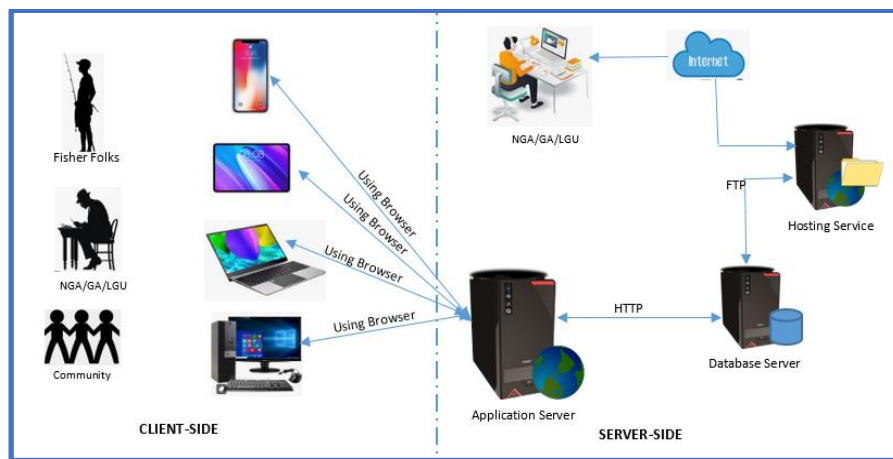

Figure 3. Architectural Design of CATCHFISH System

The specified needs and functionalities during the requirements analysis phase were transformed into operational modules for the CATCHFISH system. The development process leveraged a variety of web frameworks and technologies to ensure a robust and responsive system. For the frontend, the proponent employed a combination of PHP, JavaScript, and HTML, effectively creating an interactive and user-friendly interface. Meanwhile, MySQL was selected as the backend database to handle data management and storage efficiently. By integrating these technologies, the system was able to provide a seamless experience for users, enabling smooth interaction between the interface and the database. This approach not only ensured that the system met its functional requirements but also optimized performance, security, and scalability. Each module developed during this phase was designed to address specific aspects of the system's overall purpose, contributing to a cohesive and well-structured platform aimed at improving fishing data management and efficiency. The strategic use of these programming languages and frameworks reflects the careful consideration of both technical requirements and user experience, ensuring the successful implementation of the CATCHFISH system.

Daily reviews were systematically conducted to assess the efficiency and effectiveness of all activities carried out, ensuring the productivity of the team was consistently optimized. These reviews provided valuable insights into the progress of the project, identifying any potential areas for improvement or adjustment. In addition to the daily assessments, a comprehensive verification process was employed to thoroughly evaluate the system's interface. This process was designed to ensure that the interface adhered to recognized software quality principles, examining critical factors such as functionality, user experience, and overall design.

The verification process played a key role in identifying usability issues and potential design flaws, allowing for prompt corrective measures. By scrutinizing the user interface, the evaluation ensured that the system not only met

its technical requirements but also delivered an intuitive and user-friendly experience. Beyond interface evaluation, the system's overall performance was rigorously analyzed to address any underlying issues that could affect its functionality. This dual approach of daily reviews and systematic verification contributed significantly to maintaining high standards of quality, ensuring that the system operated effectively and aligned with the intended objectives. As a result, both the user interface and system performance were continuously refined to meet the project's goals.

The CATCHFISH system is structured around three main functional categories, such as content creation, content retrieval, and descriptive analytics. These categories collectively support the system's ability to manage fisheries-related information efficiently, catering to the varied needs of users.

The content creation, enables the entry of critical data and comprises three key sub-functionalities. The system allows for the input and recording of fisher folk profiles, facilitating the collection of essential demographic and operational data about individual fishermen. In addition, the registration of fishing gear and boats is a core component, ensuring that every piece of equipment and vessel used in fishing activities is logged and accounted for. This process not only helps in tracking fishing operations but also supports regulatory compliance. Lastly, the system supports the documentation of fish catch data, allowing users to record detailed information about the quantity and types of fish caught. These sub-functionalities together form the foundation of the system, providing a robust data input mechanism that ensures accuracy and completeness.

Next, the content retrieval function provides users with easy access to the stored data for reporting and decision-making purposes. This area also comprises three sub-functionalities. First, it facilitates the retrieval of fisher folk profiles, allowing users to access individual or aggregated data as needed. Secondly, it allows for the extraction of data related to registered fishing gear and boats. Finally, it enables users to retrieve detailed fish catch records. The fish catch data can be further categorized and accessed based on three criteria: by individual fisher folk, by the type of gear used, and by boat. This flexible approach to data retrieval allows for more focused and relevant analyses, ensuring that users can extract the information most pertinent to their needs.

And the descriptive analytics function provides deeper insights by generating reports based on the stored data. Like the content retrieval function, descriptive analytics focuses on three key areas: fisher folk information, registered fishing gear and boats, and fish catch data. These reports are similarly categorized, enabling users to generate summaries and analyses by fisher folk, by gear type, or by boat. The descriptive analytics function allows users to interpret data trends and patterns, offering valuable insights that support informed decision-making.

Together, the three main functional areas of content creation, content retrieval, and descriptive analytics within the CATCHFISH system were meticulously designed to meet the operational needs of its users. By offering a comprehensive solution for data input, retrieval, and analysis, the system ensures that fisheries-related information is effectively managed, enhancing both the efficiency and the accuracy of fisheries operations.

Similarly, the CATCHFISH System's user interface were designed to facilitate user interaction with the system. The interface features a comprehensive dashboard (figure 4) that provides a summary of all data stored in the repository, presented through descriptive analytics. This dashboard serves as a central hub for users, offering a clear overview of key information and insights.

In addition to summarizing data, the dashboard includes direct links to major system functionalities. These links guide users to essential pages such as fisher folk's registration, acquisition and renewal of fishing licenses, and fish catch entry. This streamlined access ensures that users can efficiently navigate to important sections of the system, enhancing overall usability and operational efficiency. The user interface is thus designed to support a seamless and intuitive interaction experience, aligning with the system's goal of optimizing data management and user engagement.
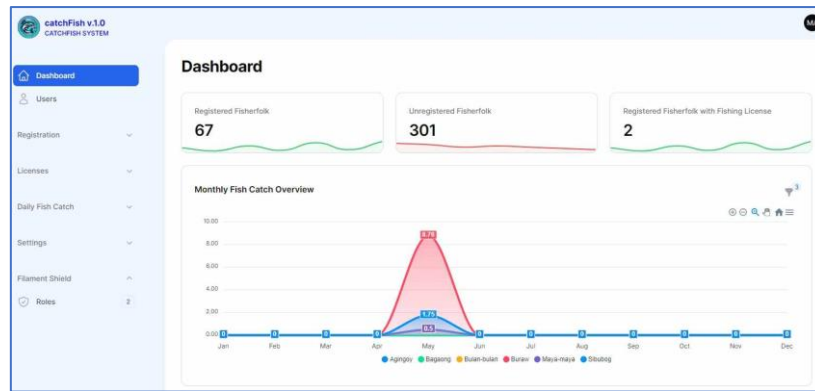
Figure 4. CATCHFISH System Homepage

Deployment

The final stage in the paradigm was the deployment phase. This is a critical stage that involved several essential activities to ensure the system's successful presentation and optimal performance. This phase was meticulously designed to address any residual issues, verify system functionality, and ensure that the system met the highest standards of usability, reliability, and acceptability.

As part of the deployment process, the system was subjected to extensive monitoring to detect and rectify any bugs or defects that might have been missed during earlier verification stages. This involved rigorous testing procedures, including functional testing, integration testing, and performance testing. The goal was to identify any anomalies or issues that could impact the system's functionality or user experience. A dedicated team of IT professionals was tasked with closely examining the system, using a combination of automated tools and manual testing techniques to ensure comprehensive coverage. Any issues identified were promptly addressed through debugging and system updates to maintain the integrity and smooth operation of the system.

Recognizing the importance of effective user engagement, the deployment phase included comprehensive training for all relevant stakeholders. This training was designed to familiarize users with the system's functionalities, ensuring they could navigate and utilize the system efficiently. The training sessions covered various aspects of the system, including data entry, content management, and the use of analytical tools. By providing hands-on experience and detailed instruction, the training aimed to empower stakeholders with the knowledge and skills needed to leverage the system's full potential. This proactive approach was crucial in fostering user confidence and ensuring a smooth transition to the new system.

Another key component of the deployment phase was the implementation of user roles and access controls. The system was configured to accommodate different types of users, each with specific roles and permissions to maintain the integrity of the information provided. LGU personnel and Fisher Folks were assigned as primary contributors to the data repository. Their roles involved entering and managing data related to fishing activities, licenses, and fish catch records. Their access levels were designed to enable comprehensive data input while ensuring that the quality and accuracy of the data were maintained. In contrast, GA/NGO/Community groups were granted restricted access, limited to content retrieval and descriptive analytics functions. These groups were primarily involved in accessing and analyzing data rather than contributing new information. This role-based access control was implemented to prevent unauthorized modifications and to ensure that sensitive data remained secure and accurate.

The deployment phase also included conducting tests with potential end-users to gather feedback and inputs on the system's performance and functionality. These user tests were structured to simulate real-world usage scenarios, allowing users to interact with the system and provide valuable insights into their experience. Feedback was collected through various methods, including surveys, interviews, and direct observation. This feedback was analyzed to identify any areas for improvement and to address any issues that users encountered. The insights gained from user testing were used to make final adjustments and enhancements to the system. This iterative feedback loop ensured that the system was refined and optimized based on actual user experiences, thereby increasing its effectiveness and user satisfaction.

The culmination of the deployment phase was the finalization of the system and its official presentation to the stakeholders. The successful deployment of the CATCHFISH System marked the end of the development process and the beginning of its operational phase. By addressing residual issues, providing comprehensive training, implementing user roles and access controls, and incorporating user feedback, the deployment phase ensured that the system was fully prepared to meet the needs of its users and to support effective fisheries management. These activities collectively contributed to the delivery of a robust and user-friendly system that is well-equipped to support its intended functions and to enhance the management of fisheries-related data and operations.

SYSTEM EVALUATION

In alignment with Jakob Nielsen's established principles for interaction design, the CATCHFISH System underwent a thorough process of testing and evaluation. This comprehensive assessment involved a diverse group of stakeholders who rigorously examined the system's user interface to ensure it adhered to recognized UI design standards. The evaluation focused on various aspects of usability, including ease of navigation, functionality, and overall user experience.

The testing process was meticulously structured to cover a wide range of user scenarios and interactions with the system. This approach was designed to capture a comprehensive understanding of the system's performance and to identify any potential areas for improvement. Stakeholders from different backgrounds and roles were involved, providing a broad perspective on the system's usability and effectiveness. Their feedback was crucial in assessing how well the system met the intended design goals and user requirements.

To quantify the results of this evaluation, the usability of the CATCHFISH Information System was measured and presented in Table 1. The system achieved an outstanding average usability score of 96.30%, categorizing it as "highly usable." This impressive score reflects the system's strong adherence to UI design principles and its overall effectiveness in providing a seamless and user-friendly experience.

Table 1: Usability Percentage of CATCHFISH System

No.	Usability Heuristics Indicators	Summary of Results (%)
1	Visibility of System Status	97.1
2	Match Between System and the Real World	96.2
3	User Control and Freedom Support undo and redo.	98.01
4	Consistency and Standards	96.2
5	Error Prevention	94.25
6	Recognition Rather than Recall	95.89
7	Flexibility and Efficiency of Use	96.5
8	Aesthetic and Minimalist Design	96.5
9	Help Users Recognize, Diagnose, and Recover from Errors	96.5
10	Help and Documentation	95.89
	TOTAL	**96.30**

Note: 90-100, Highly Usable; 70-89, Usable; 50-69, Fairly Usable; 30-49, Less Usable; 29-0, Unusable

The evaluation process not only confirmed the system's high usability but also provided valuable insights for ongoing refinement and enhancement. The feedback collected from stakeholders was analyzed to understand user needs better and to ensure that the system continues to meet the highest standards of usability. This iterative approach to testing and evaluation underscores the commitment to delivering a system that is both functional and intuitive for its users. By adhering to Jakob Nielsen's interaction design principles and conducting extensive testing with a diverse group of stakeholders, the CATCHFISH Information System has demonstrated exceptional usability. The system's high average score highlights its effectiveness in aligning with established UI design standards and ensuring a superior user experience.

The CATCHFISH System underwent comprehensive evaluation by a diverse group of stakeholders, resulting in impressive ratings that underscore its high performance in terms of acceptability and reliability. The system achieved an average rating of 95.07% for acceptability and 93.83% for reliability. These ratings are indicative of the system's high regard among users and its strong adherence to quality standards, reflecting its overall effectiveness and performance.

The average rating of 95.07% (Table 2) for acceptability demonstrates that the CATCHFISH System is considered "highly acceptable" by stakeholders. Acceptability, in this context, refers to the system's alignment with user needs, preferences, and expectations. This high rating signifies that the system meets or exceeds user requirements in terms of functionality, ease of use, and overall satisfaction.

Table 2: Acceptability Percentage of CATCHFISH System

No.	Acceptability Indicators	Summary of Results (%)
1	The objectives of the CATCHFISH System were clearly defined.	95.59
2	The CATCHFISH System is useful at my present work.	95.9
3	The use of CATCHFISH System facilitates my tasks.	97.41
4	The information provided in CATCHFISH System are helpful.	94.99
5	The contents are well organized and consistent with the objectives of the CATCHFISH System.	94.08
6	Participation and interaction of users were encouraged.	95.9
7	Instructions were clear and understandable.	95.59
8	CATCHFISH System provided opportunities to practice and reinforce previous knowledge.	94.38
9	Users are able to contribute contents into the information repository through their accounts.	92.87
10	I will use the CATCHFISH System to assist my operation.	93.95
	TOTAL	**95.07**

Note: 90-100, Highly Acceptable; 70-89, Acceptable; 50-69, Fairly Acceptable e; 30-49, Less Acceptable; 29-0, Unacceptable

Several factors contributed to this high acceptability rating. First, the system's user interface was designed with a focus on usability and intuitive navigation, ensuring that users can easily interact with and access the features they need. The interface was developed following established principles of interaction design, which prioritize clarity, efficiency, and user-friendliness. Additionally, the system's functionality was closely aligned with user requirements, as determined through extensive user research and feedback. This alignment ensured that the features and capabilities provided by the system were relevant and valuable to its intended users.

The CATCHFISH System also received an impressive average rating of 93.83% for reliability (Table 3). Reliability refers to the system's ability to consistently perform its intended functions without failure or error. A high reliability rating indicates that the system operates smoothly and dependably, providing users with a stable and effective tool for managing their activities. To achieve this high level of reliability, the system underwent rigorous testing and quality assurance processes. This included multiple stages of testing, such as unit testing, integration testing, and system testing, to identify and address any potential issues before deployment. Additionally, the system was subjected to stress testing to evaluate its performance under high-load conditions. The successful results of these tests contributed to the system's high reliability rating, demonstrating its robustness and capacity to handle real-world usage scenarios.

Table 3: Reliability Percentage of CATCHFISH System

No.	Reliability Indicators	Summary of Results (%)
1	The information presented in the system is accurate, complete, and current.	95.45
2	Content and context are consistent with the objectives of the CATCHFISH SYSTEM.	95.75
3	All information relates to the stated purpose and project goals.	96.97
4	Multimedia appears to be directly related to the stated purpose and project goals.	95.45
5	The layout is clear and intuitive, users can always find what they need.	92.12
6	The pages work in most common browsers like Mozilla, Google Chrome, Internet Explorer, etc.	96.06
7	Paragraphs and sections have clear and accurate informative headings.	92.42
8	Clear and complete directions are available for access.	92.42
9	Help users recognize, diagnose, and recover from errors.	88.78
10	Can bring a failed system to full operation.	92.9
	TOTAL	**93.83**

Note: 90-100, Highly Reliable; 70-89, Reliable; 50-69, Fairly Reliable; 30-49, Less Reliable; 29-0, Unreliable

Tables 2 and 3 provide detailed summaries of the ratings for acceptability and reliability. These tables offer a quantitative view of the system's performance based on stakeholder feedback. The acceptability ratings reflect the system's alignment with user needs and satisfaction, while the reliability ratings indicate its consistent performance and dependability. The high ratings achieved by the CATCHFISH System underscore the success of the development process and the effectiveness of the system in delivering valuable and reliable solutions. The adherence to quality standards and the structured approach of the development paradigm were key factors in achieving these outstanding evaluations.

The exceptional ratings for both acceptability and reliability can be attributed to the system's adherence to stringent software quality standards and the CATSYS Software Development Paradigm. This development paradigm was designed to ensure that the system meets the highest standards of quality throughout its lifecycle. The development process involved the application of well-recognized software quality standards, which guided the design, development, and testing phases of the project. These standards provided a framework for ensuring that the system's features and performance met industry benchmarks and best practices. Key aspects of these standards included adherence to coding guidelines, implementation of comprehensive testing procedures, and incorporation of user feedback into the development process. The CATSYS Software Development Paradigm also played a crucial role in achieving high ratings. This paradigm encompassed a structured approach to software development, including phases such as requirements analysis, design, development, testing, and deployment. Each phase was carefully executed to ensure that the system was developed according to predefined quality criteria and that any issues were addressed promptly.

The evaluation process involved a diverse group of stakeholders, including end-users, system administrators, and other relevant parties. Their feedback was instrumental in assessing the system's performance and identifying areas for improvement. The involvement of various stakeholders provided a comprehensive perspective on the system's usability and effectiveness, contributing to the accuracy of the acceptability and reliability ratings.

Feedback from stakeholders was collected through various methods, including surveys, interviews, and direct observation. This feedback was analyzed to gain insights into user experiences and to identify any issues or concerns. The findings from this analysis were used to make necessary adjustments and enhancements to the system, ensuring that it continued to meet the needs of its users and maintain high standards of performance.

CONCLUSION AND RECOMMENDATION

The CATCHFISH System represents a significant advancement in addressing the challenges faced by the fishing industry, particularly in the coastline along Lagonoy Gulf. By centralizing and optimizing fisheries data through an innovative digital repository, the system has demonstrated its potential to enhance fishing practices, support sustainable resource management, and improve the livelihoods of local communities.

The system's core functionalities, which include content creation, retrieval, and descriptive analytics, were meticulously designed to address critical gaps in existing ICT tools for fisheries management. The emphasis on collaboration among stakeholders—fishermen, local government units (LGUs), non-governmental organizations (NGOs), and community groups—ensures that all parties can contribute to and benefit from a unified source of information. This collaborative approach not only facilitates more efficient data management but also fosters a shared commitment to sustainable fishing practices.

The CATCHFISH System was subjected to rigorous evaluation by stakeholders, achieving notable ratings of 95.90% for usability, 94.67% for acceptability and 93.33% for reliability. These ratings underscore the system's alignment with user needs and its dependable performance. The high acceptability rating reflects the system's usability, ease of navigation, and relevance to users' requirements. The high reliability rating indicates that the system consistently performs its intended functions without error, demonstrating its robustness and stability. The successful development and evaluation of the CATCHFISH System highlight its potential to transform fisheries management by providing a comprehensive and integrated platform for data collection, analysis, and decision-making. The system's alignment with global and local sustainability goals, such as the United Nations Sustainable Development Goals (SDGs) and the Ecosystem Approach to Fisheries (EAF), reinforces its role in promoting responsible and sustainable use of marine resources.

Given the limited research on the development and evaluation of information systems tailored to support marginalized sectors within the country, this study aims to provide valuable insights into software quality principles and competencies. These principles are essential as universal standards for various software development projects, enhancing customer satisfaction and optimizing user experience. The findings from this research are expected to serve as a reference for improving software development practices across different sectors. Furthermore, the implementation of the CATCHFISH System among diverse stakeholders is anticipated to significantly contribute to the sustainable development of the fishing industry. By facilitating more efficient and responsible management of marine resources, CATCHFISH will help ensure the industry's continued growth and resilience. This initiative is crucial for preserving marine ecosystems and securing the livelihoods of future generations, reinforcing the system's role in fostering long-term sustainability in the fishing sector.

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