Developing a Web-Based Maritime Safety and Incident Reporting System: Enhancing a Realtime Traceability for Fishing Vessels in Northern Samar

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RECOMMENDATION AND ACCEPTANCE

The Research Proposal titled **“Developing a Web-Based Maritime Safety and Incident Reporting System: Enhancing a Realtime Traceability for Fishing Vessels in Northern Samar”** prepared and submitted by **Aira P. Reyes, Arian T. Rollo, John Kinnith H. Socito** and **Jehiel A. Tuan** in partial fulfillment of the requirements for the degree of Bachelor of Science in Computer Science has been examined and hereby recommended for approval and acceptance.

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APPROVAL

Approved and accepted by the committee on the actual conduct of this thesis proposal.

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APPROVAL FOR COMPLETION

Thesis Title: Developing a Web-Based Maritime Safety and Incident Reporting System: Enhancing a Realtime Traceability for Fishing Vessels in Northern Samar

This thesis is suitable for submission.

MARY JOYCE V. JOPIO

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I certify to the best of my knowledge that the required procedures have been followed and preparation criteria have been met for this Thesis.

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The Researcher

Dedication

This research, "Developing a Web-Based Maritime Safety and Incident Reporting System: Enhancing a Realtime Traceability for Fishing Vessels in Northern Samar," is devoted:

To God Almighty, for the wisdom, strength, and unwavering guidance He bestowed upon us throughout our academic journey.

To the Small Fishermen of Northern Samar, whose courage at sea and urgent need for a reliable digital lifeline served as the primary motivation for this work, and whose safety and sustained livelihood are the ultimate purpose of this system.

To the Philippine Coast Guard and Emergency Response Authorities, and the Barangay Officials who are dedicated to maritime governance and timely rescue operations, and who will use this system to enhance situational awareness and save lives.

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May this system serve as a testament to the potential of technology to protect lives and sustain coastal prosperity.

The Researcher

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Abstract

Coastal communities in Northern Samar, Philippines, depend on small-scale fishing. They face high risks of maritime accidents and loss of life due to delayed and fragmented incident reporting. Existing safety infrastructure lacks real-time tracking and reliable communication, especially in areas with weak cellular signals. This limits search and rescue operations. This study develops a Web-Based Maritime Safety and Incident Reporting System for fishing vessels in the region. The system features real-time global positioning system location tracking, a one-press emergency alert, and a centralized dashboard for maritime authorities to manage reports efficiently. It uses the Agile Scrum Model to gather feedback and remain adaptable for non-technical users. The prototype was evaluated using ISO/IEC 25010:2011 quality characteristics, focusing on Functional Suitability, Reliability, and Usability. Evaluation methods include a Likert-scale questionnaire and thematic analysis of user interviews. The system aimed to meet quality standards, improve maritime governance, accelerate emergency response, and reduce human and economic losses in vulnerable fishing communities.

Keywords: Web-Based Maritime Safety System, Incident Reporting System, Real-Time Vessel Traceability, GPS-Based Tracking, Fishing Vessels, Emergency Response System, Maritime Safety, Coastal Communities, ISO/IEC 25010 Evaluation.

Chapter 1

Introduction

Background of the Study

Coastal communities in Northern Samar depend on fishing for daily income. These activities are part of their daily survival and livelihood. With this means of living comes a high risk from sudden weather changes, equipment failure, and accidents at sea. Reports of delayed rescues and loss of lives are common in areas with weak communication. Existing methods are manual, slow, and unreliable, leaving many emergencies unreported or responded too late. These delays put lives, income, and local resources in danger. To address these problems, web-based maritime safety and incident reporting system will provide. It provides real-time tracking, structured incident reporting, and immediate alerts. The system strengthens emergency response and creates a dependable communication channel for both authorities and local communities. It also supports the economy by reducing losses during accidents, preventing unnecessary delays in fishing activities, and providing accurate data for planning, rescue operations, and policy-making.

The study belongs to web-based systems, real-time computing, and human-computer interaction. It applies technologies that connect multiple users in different locations through a single online platform. The system was designed to work in resource-limited environments where strong infrastructure is not evident. Web technologies allow access across devices, which are widely used by fishermen. Real-time computing ensures immediate communication during emergencies so that delays in response are reduced. Human-computer interaction ensures that the interface is simple and easy to use for individuals with limited technological knowledge. Database management provides secure storage of reports, tracking data, and emergency records that can be retrieved by authorities for analysis and response.

In the Philippines, current maritime reporting systems in the Philippines are fragmented and limited in scope. Many rely on outdated methods such as manual logging and radio communication, which often delay incident reporting and fail to capture real-time data (Santos, 2021). These practices hinder search and rescue operations, especially in remote coastal areas where communication infrastructure is limited. Thus, centralized web-based maritime safety and reporting platform provides a clear improvement by integrating tracking, alerts, and reporting into a single system. This approach ensures faster response, accurate location tracking, and better coordination among agencies involved in maritime safety (Cruz & Mendoza, 2020). Moreover, a digital system improves the accuracy of records, supports long-term data analysis, and aids authorities in planning resource allocation for high-risk areas. These improvements create a more structured and efficient safety management process that directly addresses the limitations of existing practices.

This study responds to the urgent need for a better system to manage maritime safety in Northern Samar. The study aims to develop a reliable, real-time incident reporting platform that addresses communication gaps experienced by fishing vessels. Traditional reporting methods have been shown to be insufficient for timely rescue operations, especially in areas with limited access to communication networks (Garcia & Lopez, 2022). By developing a web-based system, the research introduces a practical solution that ensures faster reporting and immediate response to maritime incidents. The project also reflects on the broader aim of computer science research, which is to design systems that improve daily life and safety in marginalized communities (Rahman et al., 2019). The desire to find a better way to respond to emergencies not only drives innovation but also ensures that technology is applied in a way that protects lives and sustains livelihoods.

The development of a web-based maritime safety and incident reporting system provides a sustainable response to long-standing communication gaps in Northern Samar by addressing both operational and governance-level challenges in maritime safety. Through the integration of real-time vessel tracking and emergency alert mechanisms, the system significantly enhances the efficiency of maritime rescue operations by ensuring that distress signals and location data are transmitted immediately to monitoring authorities. Kumar and Singh (2021) emphasize that real-time computing systems are critical in emergency management contexts because they reduce response latency, improve situational awareness, and support rapid decision-making during time-sensitive incidents. By delivering timely and accurate information, the proposed system enables authorities to deploy rescue resources more effectively and minimize uncertainty during emergency situations. Beyond its immediate safety impact, the system contributes to long-term community resilience by generating reliable, structured data that can inform risk assessment, operational planning, and policy formulation. As noted by David (2020), data-driven systems designed for resource-limited environments play a vital role in strengthening institutional capacity and improving the sustainability of public safety initiatives. This study therefore demonstrates how core principles of computer science such as real-time data processing, system integration, and user-centered design can be applied to address critical maritime safety challenges, highlighting the role of technology as both a protective mechanism and a driver of development in vulnerable coastal communities.

Statement of the Problem

Generally, this study aims to develop a web-based maritime safety and incident reporting system to improve real-time traceability and emergency response for fishing vessels in Northern Samar.

Specifically, it sought to answer the following questions:

1. How can the Web-Based Maritime Safety and Incident Reporting System be designed and developed to:
   a. Provide robust real-time location tracking for fishing vessels, including functionality in areas with limited or low cellular signal;
   b. Facilitate immediate and simplified incident reporting for fishing boat, including a one-press emergency alert mechanism;
   c. Establish a centralized, user-friendly dashboard for maritime authorities (e.g., Philippine Coast Guard) to monitor fishing vessels locations and manage incident reports efficiently; and
   d. Ensure a resilient communication protocol that optimizes data transmission for emergency alerts and location updates, even in challenging connectivity environments?
2. How can the compliance level of the Web-Based Maritime Safety and Incident Reporting System with the quality characteristics defined by ISO/IEC 25010:2011 (e.g., Functional Suitability, Reliability, Usability, Performance Efficiency, Security, Maintainability, Portability) be evaluated?
3. How can the Web-Based Maritime Safety and Incident Reporting System be effectively implemented in the context of the maritime communities of Northern Samar, considering user adoption and operational integration with local authorities?

Purpose and Description

The study aims to design and develop a web-based maritime safety and incident reporting system that addresses delayed and inefficient emergency reporting among fishing vessels in Northern Samar. A system that provides a reliable and user-friendly platform using responsive design, and real-time tracking tools. Its purpose is to improve maritime safety, speed up emergency response, and enhance incident traceability.

This project bridges the gap between unreliable communication methods and the goal of timely, accurate, and accessible reporting. Using modern web development frameworks and user-centered design principles, the system was evaluated against established software quality standards to ensure it meets the operational needs of users and stakeholders.

Specifically, the system aims to:

1. Enable real-time location tracking of fishing vessels through GPS.
2. Provide a user-friendly web-based interface for real-time vessels monitoring, manage vessels the ability to create, update, and delete.
3. Allow local authorities and maritime responders to access real-time incident reports and boat locations.
4. Maintain accurate data logging for each trip and incident to support traceability and post-incident investigation.
5. Evaluate the system based on functionality, reliability, usability, and efficiency using the ISO/IEC 25010:2011 software quality standards.
6. Promote maritime safety awareness and preparedness among local fishermen through accessible and practical digital tools.

This system improves maritime safety in Northern Samar by giving fishermen and emergency responders a reliable digital lifeline. It also reduces human and economic losses from incidents. Moreover, this system aims to serve as a model for technology-driven safety solutions in other coastal regions. The results of this study will benefit the following:

1. **Small Fishermen:** They will experience enhanced safety and security at sea through constant traceability and a reliable means of emergency communication, significantly reducing their vulnerability during distress.
2. **Philippine Coast Guard and Emergency Response Authorities:** They will benefit from centralized, real-time incident logs, enhanced situational awareness, and faster, more coordinated response capabilities, improving overall maritime governance and emergency management.
3. **Future Researchers:** The findings and developed prototype will serve as a practical case study, contributing to the body of knowledge on applying web technologies and resilient communication solutions in challenging maritime environments, thereby supporting future innovations in public safety systems.

Scope and Delimitation

The study was focused on designing, developing, and initial validation of a web-based maritime safety and incident reporting system. It is tailored to meet the operational and safety needs of fishing vessels, mainly those used by fishermen in Northern Samar, Philippines.

The system features GPS tracking, a simplified emergency alert mechanism, and a user-friendly dashboard for both seagoing operators and onshore monitoring authorities such as the Philippine Coast Guard. It provides a real-time tracking data, and transmit location updates directly to monitoring centers to improve safety and enable rapid, coordinated responses.

The study did not include high-end satellite communication equipment. The study focuses on optimizing data transmission for areas with limited, intermittent, or no cellular network coverage. Initial deployment and testing will be limited to Northern Samar, and nationwide implementation is outside the scope.

In addition, the system focuses on incident reporting and real-time traceability. It will not include advanced navigational charting, in-depth weather forecasting beyond public data feeds, or full maritime traffic management and collision avoidance. It also supports existing safety authorities by providing valuable data, excluding the creation and enforcement of maritime regulations. The research was focused on conceptualization, development, and prototype validation. Long-term operational impact, sustained functionality, and scalability for broader use requires separate research after successful prototype deployment.

Chapter 2

Review of Related Literature

Technical Background

The development of a web-based maritime safety and incident reporting system for coastal communities, particularly fishing boat in Northern Samar, Philippines, necessitates a comprehensive understanding of several core technological domains. This project is situated at the intersection of Web Development, Real-time Systems, and Human-Computer Interaction (HCI). It is predicated on principles of real-time data processing and the design of robust communication protocols suitable for distributed, resource-limited environments (David, 2020).

Maritime safety is a major concern in global fisheries, especially for small-scale fishing operations that make up most of global fishing activity. The Australian Maritime Safety Authority (2020) reported an increase in serious marine incidents, with fishing vessels accounting for a higher share of very serious and serious cases than other vessel types. Real-time traceability technologies in safety and reporting systems represent a key advancement. They protect fishermen, improve operational efficiency, and support regulatory compliance.

Philippine Maritime Safety Statistics and Incident Reporting

The Maritime Industry Authority of the Philippines (2022) reported an accident investigation data showing clear trends. Which was grounded on the most frequent accident type with 47 cases, and Engine failure followed with 12 cases. Allision, capsizing, and fire or explosion each recorded 8 cases. The accident classification system recorded 13 very serious accidents, 90 serious accidents, and 12 less serious incidents. Regional data showed Maritime Regional Office IV with the highest number of cases at 35, followed by MRO VII with 18 and MRO VI with 14.

Emergency Communication Systems for Small Boats

Mejias and Malabanan (2019) developed a prototype emergency communication system for small fishing vessels. The system used GPS geolocation software to track vessel paths and positions through wireless mesh networks. On-board devices transmitted emergency signals to base stations and received warning signals from them. Tests confirmed distress signals reached base stations and warning signals could be sent up to 5.4 kilometers. The study showed that Sub-1 GHz wireless transmission supports open sea communication and enhances safety for small-scale fishermen.

Vessel Tracking Systems

Research on vessel tracking system temporal resolution (2024) showed that monitoring relies on Global Navigation Satellite Systems integrated into Vessel Monitoring Systems, Automatic Identification Systems, or Mobile Tracking Systems. VMS transmits vessel position, speed, heading, and ID at fixed intervals via satellite. The data is secured because it is not public and it provides a broad coverage of fishing activity. AIS, created under SOLAS for maritime safety, is mandatory for merchant vessels over 300 GT and since 2014 for EU fishing vessels over 15 meters. AIS uses radio signals with shore and satellite receivers. It supports traffic monitoring and safety, though coverage is uneven.

AIS and Marine Traffic Monitoring

AVS Global Supply (2025) reported that AIS underpins modern marine traffic monitoring. It broadcasts vessel identification, position, course, speed, destination, estimated time of arrival, cargo type, and dimensions. Coastal receivers and satellites capture the signals, which are processed in real time and displayed on traffic maps online or in applications. AIS improves safety by reducing collision risk and increasing situational awareness. It improves efficiency through route optimization and lower fuel use. It increases transparency for stakeholders and supports compliance with regulations.

Fishing Activity Estimation

Frontiers in Marine Science (2023) proposed new methods for estimating fishing activity from VMS data in lightly impacted areas. The methods tested included nested grids with variable cell sizes, Voronoi diagrams defining polygons around data points, and local regression to create smoothed maps of fishing intensity. These were compared with standard grids and track interpolation. Which performed best. Local regression was the strongest alternative when track interpolation was not possible.

Related Literature

The International Journal of Safety and Security Engineering (2024) showed that weather is the leading cause of fishing vessel accidents. Smaller vessels under 30 GT remain outside the coverage of current tracking systems. These gaps expose a large part of the fishing fleet to risks. The study recommended extending AIS and Vessel Monitoring Systems to smaller vessels and implementing stronger safety management systems.

Similarly, the ForeSea Project Final Report (2020) described a reporting system that collects accident, near miss, and deviation data. Reports are submitted through company safety officers and stored anonymously in a database. The database supports benchmarking and risk analysis. This system captures safety issues not normally reported to regulators, giving operators a tool to act before accidents escalate.

The Journal of Business, Technology and Human (2022) reviewed 103 studies on maritime networks. It identified maritime safety as one of six critical areas needing systematic attention. The research showed that safety networks require integrated technology and innovation to improve effectiveness and reduce incidents.

A review of Ocean Engineering (2024) analyzed the resilience of maritime transport research from 1997 to 2023. The bibliometric study identified key clusters in technological integration, regulatory compliance, and real-time monitoring. These were found to be the backbone of modern safety systems and reporting frameworks.

The Maritime Technology and Research (2024) outlined 28 challenges and 90 opportunities in domestic ferry safety. The study grouped the challenges into five areas: operations, technology, human factors, regulation, and economics. It highlighted weak policy, lack of governance, and poor standardization as immediate issues that need capacity building and regulatory reform.

Synthesis

Maritime safety and incident reporting systems from 2016 to 2025 show clear advances. Real-time traceability has become the core feature. The focus is protecting fishing vessels through faster and more reliable data flow.

Real-time monitoring and reporting are now the standard. Vessel Monitoring Systems, Automatic Identification Systems, and integrated sensor networks provide continuous streams of position, speed, and environmental data. This data supports incident management and helps operators avoid risks. Studies show that real-time data reduces accidents and builds safety culture (Bachtiar et al., 2024; AVS Global Supply, 2025; Solla et al., 2023).

Human and technical factors remain the main causes of maritime incidents. Most accidents stem from both. Modern safety systems reduce risks by combining training, safety culture, and user-friendly designs with reliable sensors, analytics, and decision support systems. Strong management commitment is also essential (Rahman, Sari, & Wijaya, 2025; TransNav, 2024).

Differences between developed and developing regions are sharp. Developed nations deploy AIS, VMS, and satellite monitoring with wide coverage. Developing countries like the Philippines and Indonesia struggle with extending systems to small vessels under 30 gross tons and ensuring stable communication in remote seas (Bachtiar et al., 2024; Philippine MARINA Reports, 2022). These gaps leave small-scale fishers more exposed to danger and highlight the need for low-cost and adaptable solutions.

Incident reporting methods vary for each nation.Sweden’s ForeSea system collects anonymous reports of accidents and near misses, giving reliable data for analysis and benchmarking (ForeSea Project, 2020). By contrast, systems in some developing countries depend on mandatory reporting or manual logs. This leads to underreporting and weak data, which reduces the effectiveness of safety measures (Philippine MARINA, 2022).

Regulation and policy are also key drivers of maritime safety outcomes. Developed regions operate with strong frameworks and strict enforcement of Safety Management Systems and standardized reporting practices, which promote accountability, consistent compliance, and continuous safety improvement across maritime operations (TransNav 2024). In contrast, developing regions face fragmented regulations and weak enforcement mechanisms, which limit compliance, reduce reporting accuracy, and slow the formation of a sustained safety culture. These gaps create a need for focused investment in institutional capacity, regulatory alignment, and training programs to support effective implementation and long-term safety governance.

Technology integration shows another clear gap across regions. Developed regions deploy artificial intelligence, machine learning, and Internet of Things technologies in maritime safety systems. These tools support predictive risk analysis, automated navigation support, and continuous vessel monitoring, which improve incident prevention and operational awareness (Liu et al. 2025; Pushkeria and Shree 2024) report that data driven monitoring systems reduce human error by supporting early warning and decision support functions. In developing regions, you still rely on basic tracking and communication systems because of limited infrastructure, high deployment costs, and restricted technical capacity. This gap slows adoption of advanced safety technologies and reinforces the need for scalable systems designed for low resource maritime environments.

Between 2016 and 2025, maritime safety systems improved through real-time traceability and integration of human and technical elements. Developed regions move toward AI-driven frameworks, while developing ones seek affordable, context-fit solutions. The challenge is balancing advanced innovation with practical measures to ensure safety for all maritime communities, especially vulnerable small-scale fishers.

Chapter 3

Research Methodology

Research Locale

The study was focused in Northern Samar, Philippines, with specific coverage of coastal municipalities where small fishing boats operate daily. These areas include Allen, Biri, Bobon, Capul, Catarman, Catubig, Gamay, Laoang, Lapinig, Lavezares, Mapanas, Mondragon, Palapag, Pambujan, San Antonio, San Isidro, San Jose, San Roque, and San Vicente. You find a high concentration of small-scale fishing activities in these municipalities, along with recurring communication gaps and limited access to organized emergency support. These conditions increase response delays during maritime incidents and highlight the need for a localized digital safety and incident reporting system.

Northern Samar has 24 municipalities, 19 of which are coastal. It has about 200 coastal barangays and a 429-kilometer coastline (BFAR, 2023). Maritime activity is central to local livelihood. Most operators use small boat and have limited technical knowledge (Garcia, 2022).
The area’s geography, scattered islands, and poor communication infrastructure create high safety risks. Emergency reporting often depends on slow or unreliable channels (David, 2020). This makes the province an ideal location for testing real-time tracking, emergency alerts, and digital reporting. Previous studies also note challenges that highlight the need for low-cost, reliable systems suited for non-technical users. The combination of high maritime traffic, vulnerable communities, and poor connectivity aligns with the project’s aim to improve safety through targeted technology (Garcia, 2022).

Framework of the Study

The theoretical foundation for developing a web-based maritime safety and incident reporting system in Northern Samar integrated multiple frameworks that address technological, human, organizational, and environmental factors. Systems theory and the System-Theoretic Accident Model and Processes (STAMP) provide the first layer, conceptualizing safety as an emergent property of interactions between vessels, communication infrastructure, weather, rescue centers, and fishing communities (Wróbel et al., 2017). STAMP shifts the focus from preventing component failures to ensuring effective system control, which is vital for Northern Samar where maritime accidents reached 188 in 2023, a 63 percent increase from the previous year (Maritime Industry Authority, 2024).

The second layer applies Davis's Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT), which explains system adoption through perceived usefulness, ease of use, performance expectancy, effort expectancy, social influence, and facilitating conditions (Davis, 1989; Venkatesh et al., 2003). These models stress that fishermen's acceptance depends on safety benefits, interface simplicity, community endorsement, and training support.

The third layer draws from Information Systems Design Theory (ISDT) and Real-time Traceability frameworks, which guide system design through requirements analysis, user-centered design, and integration of real-time vessel tracking, incident reporting, emergency alerts, and analytics (Walls et al., 1992; Ngai, 2010). Traceability theory adds the need for continuous data capture, adaptive response to unpredictable operations, and resilience in limited communication environments.

Together, these frameworks form an integrated model addressing four dimensions: technological robustness, human acceptance, organizational support, and environmental adaptation. This model ensures that the system aligns with user needs, fosters safety culture, complies with regulations, and adapts to Northern Samar's harsh maritime conditions. It also supports phased implementation strategies, focusing on technical excellence, user training, organizational backing, cultural integration, and sustainable operation. This integration provides both a strong theoretical base for system design and practical strategies for successful adoption in local fishing communities.

Software Development

This study utilized the Agile Scrum Development Model which supports continuous improvement and allows the system to adapt to changing requirements. It suits testing user interaction in dynamic and high-risk settings. The iterative approach focuses on frequent feedback and adaptive planning. This matches the goal of building a simple and reliable system for non-technical users in a complex maritime environment (Wicaksono & Baswara, 2020).

IPO (Input-Process-Output)

Figure 1

Input, Process, Output Diagram

INPUT

System Requirements

- ***Knowledge***
  Programming
  - **Frontend**
    CSS, HTML, JavaScript
  - **Backend**
    PHP, MySQL
  - **Operation**
    CRUD
- ***Software***
  - Database (Xampp)
  - IDE (Visual Studio)
  - Google Chrome
  - Ngrok
- ***Hardware***
  - Mobile Device
  - Standard PC or Laptop
  - Wifi Router (Internet Connection)

PROCESS

Agile Scrum Development Model

- Product Backlog Creation
- Sprint Planning
- Sprint Execution
- Daily Scrum
- Sprint Review
- Sprint Retrospective
- Increment Delivery

OUTPUT

A Web-Based Maritime Safety and Incident Reporting System: Enhancing Traceability for Fishing Vessels in Northern Samar

The researcher used the following steps and phases to develop a system prototype:

Product Backlog Creation - The process begins with identifying the features and functions that the system must support. The researchers gathered requirements from stakeholders and translate them into user stories. Each user story describes what the system should do from the perspective of the user. These items are stored in the product backlog and ranked by priority.

Sprint Planning - Sprint planning turns backlog items into a concrete plan of action. The team selected a set of and can be completed in a short time frame, usually two to four weeks. Sprint goals defined what the team must achieve before the sprint ends. For instance, in the first sprint of a reporting system, the team focuses on building a functional login module. This phase ensures that the workload is realistic and the objectives are clear.

Sprint Execution - During sprint execution, the team designed, coded, and tested the features chosen in planning. The focus is on producing a working piece of the system by the end of the sprint. Developers and testers collaborated closely to address issues quickly. In a web-based prototype, this involved creating front-end forms, setting up server logic, and connecting to a database. The output of this phase is a usable part of the system that can be reviewed.

Daily Scrum - The daily scrum was a short meeting that keeps the team aligned. Each member reported on what they have completed, what they plan to do next, and what problems they encounter. These updates helped the team identify obstacles and fix them quickly.

Sprint Review - At the end of a sprint, the team presented the working prototype to stakeholders. This review allowed stakeholders to test the system and provide feedback. The sprint review ensures that the project stays aligned with user needs. In the case of a reporting system, a stakeholder may suggest improving the incident report form for easier input. Feedback from this phase flows back into the backlog for future sprints.

Sprint Retrospective - The retrospective focuses on the process, not the product. The team reflected on what went well, what did not, and what should be improved. For instance, if testing took longer than planned, the team may decide to adjust test coverage or assign more testers. This phase strengthens team performance and builds efficiency for the next sprint.

Increment Delivery - Each sprint ends with a working increment of the system. This increment adds to the previous work, forming a system that grows with each sprint. A web-based prototype, this results to a progressively usable application after every cycle. By the final sprint, the prototype has evolved into a system that reflects user needs and supports the intended functions.

Data Collection and Instruments

Data was collected using a combination of usability testing, a survey questionnaire, and structured interviews to measure key attributes such as usability, functionality, reliability, performance efficiency, and overall user satisfaction and system acceptability.

The main instrument for quantitative data collection was a Likert-scale type questionnaire, designed to assess user satisfaction and system acceptability based on the ISO/IEC 25010 quality characteristics. This questionnaire was validated by experts in the maritime safety and software quality assurance, and pilot tested with a small group of target users to ensure clarity and relevance. For qualitative insights, an observation checklist was used during usability testing to record user interactions and identify pain points, and a structured interview guide was employed to gather detailed feedback from maritime authorities and key stakeholders.

Scale Interpretation for Likert-scale type questionnaire:

5 – Strongly Agree

4 – Agree

3 – Fair

2 – Disagree

1 – Strongly Disagree

Data Analysis Plans

The collected data was analyzed using appropriate statistical tools to determine user satisfaction, system acceptability, and compliance with ISO/IEC 25010 quality characteristics. For quantitative data from the Likert-type scale questionnaire, Weighted Mean, Frequency, and Percentage will be calculated.

The evaluation focused on the most relevant quality attributes for an early-stage prototype, specifically usability, functionality, reliability, efficiency, and user satisfaction. Other attributes such as maintainability, portability, and security were acknowledged but excluded from the current scope due to prototype limitations. These are reserved for future research and development.

Weighted Mean Formula:

Formula:

$$\tilde{x} = \frac{\sum f x}{n}$$

Where:

- $\tilde{x}$ = Mean
- f = Weight assigned to each response
- x = Number of respondents
- n = Total number of respondents

This formula helped synthesize the varying degrees of agreement into a single numerical value that reflects the overall perception of the respondents. The higher the mean, the greater the level of acceptance and satisfaction toward the system.

Table 1

Range of Weighted Mean and Data Interpretation

Range of the Weighted Mean	Interpretation
4.51 – 5.00	The system is highly accepted and demonstrates excellent performance in all key areas.
3.51 – 4.50	The system is accepted with minor conditions and meets most functional and usability expectations.
2.51 – 3.50	The system receives a fair or neutral evaluation, indicating moderate performance or uncertainty in its effectiveness.
1.51 – 2.50	The system is accepted with major conditions, requiring substantial improvements to meet user expectations.
1.50 and below	The system is rejected due to significant shortcomings and failure to meet core evaluation criteria.

Respondents whose ratings fall within the range of 4.51 to 5.00 are considered to have highly accepted the Web-Based Maritime Safety and Incident Reporting System, reflecting strong satisfaction and clear endorsement of its performance and functionality. Those within the 3.51 to 4.50 range indicate acceptance with minor conditions, showing general satisfaction while suggesting minimal enhancements. Ratings between 2.51 and 3.50 reflect fair or neutral feedback, suggesting a moderate or undecided stance with neither strong support nor outright rejection. Scores ranging from 1.51 to 2.50 imply acceptance with major conditions, indicating notable deficiencies and a need for significant improvements. Finally, ratings from 1.00 to 1.50 signify rejection of the system, reflecting strong disagreement and dissatisfaction with its ability to meet user expectations.

Qualitative data from observations and interviews were analyzed using thematic analysis to identify recurring patterns, challenges, and suggestions for improvement, providing deeper insights into user experience and operational integration.

Table 2

Statistical Interpretation

Numerical Range	Verbal Interpretation	Actionable Description (ISO/IEC 25010)
4.21 – 5.00	Excellent	The system exceeds all quality standards; no revisions are required for deployment.
3.41 – 4.20	Very Satisfactory	The system is highly functional with minor UI/UX refinements recommended.
2.61 – 3.40	Satisfactory	The system meets basic requirements but requires optimization in performance or security.
1.81 – 2.60	Fair	The system has significant functional gaps; major architectural changes are necessary.
1.00 – 1.80	Poor	The system fails to meet international standards and is not suitable for use.

Note: By applying weighted mean analysis, this study moves beyond purely subjective assessment and provides an objective, data-driven evaluation of the Web-Based Maritime Safety and Incident Reporting System. This approach ensures that system performance across key ISO/IEC 25010 quality characteristics—including Functional Suitability, Usability, Reliability, Performance Efficiency, and Security—is measured with statistical rigor.

The interpretation scale enables the researchers to identify specific areas requiring refinement, such as real-time GPS vessel tracking accuracy, emergency alert responsiveness, data transmission stability, dashboard usability, and system reliability under limited connectivity conditions, prior to wider implementation.

The scale serves as the primary analytical tool for determining how effectively the system supports real-time maritime incident reporting, vessel traceability, and emergency response coordination. User feedback collected through the software evaluation instrument is converted into precise quantitative values, which are systematically mapped to verbal interpretations and actionable descriptions aligned with ISO/IEC 25010:2011 software quality standards.

Formula:

$$\bar{x}\omega = \frac{\sum(f \cdot \omega)}{N}$$

Where:

- $\bar{x}\omega$ = Weighted Mean
- $\sum$ = Summation
- f = Frequency of responses for each scale
- ω = Weight assigned to each scale (5, 4, 3, 2, 1)
- N = Total number of respondents

Note. A higher weighted mean indicates a higher level of system acceptance and user satisfaction, while a lower value indicates areas needing system improvement.

Standard Deviation

To determine the consistency and level of agreement among evaluators, the Standard Deviation (SD) was also computed. While the weighted mean identifies the central performance score of the system, the standard deviation measures the spread of responses, indicating whether evaluators share similar perceptions of the system's quality.

A lower standard deviation value indicates strong agreement among evaluators, while a higher value suggests greater variability in user experience and perception.

Table 3

Standard Deviation Range and Interpretation

Standard Deviation Range	Interpretation	Impact on Application Evaluation
0.00 – 0.50	Highly Consistent	Evaluators strongly agree on the performance of the Input score and total modules.
0.51 – 1.00	Consistent	There is a general consensus exists regarding the system's quality based on ISO/IEC 25010 quality standards.
1.01 – 1.50	Moderately Dispersed	Responses vary; some users may find the Base Grade configuration more intuitive than others.
Above 1.50	Highly Dispersed	There is a significant disagreement in the feedback, indicating a need to re-evaluate the Result logic.

Note. This table presents the standard deviation ranges used to assess consistency among evaluators' responses. Lower values indicate strong agreement on system quality, while higher values suggest variability in user experience and perception.

While the weighted mean determines the overall performance level of the Web-Based Maritime Safety and Incident Reporting System, the standard deviation explains the degree of agreement among evaluators regarding the system's quality. A low standard deviation indicates that evaluators share a consistent assessment of the system's functional suitability, usability, reliability, and performance efficiency, suggesting stable system behavior across different usage scenarios. In contrast, a high standard deviation reflects greater variability in user experience, which may be attributed to differences in device hardware, GPS accuracy, network connectivity, browser performance, or environmental conditions encountered during system use.

The analysis of standard deviation provides valuable insight into the consistency and dependability of the system across the ISO/IEC 25010 quality dimensions, particularly in real-time vessel tracking, emergency alert responsiveness, and dashboard performance. This measure complements the weighted mean by identifying whether observed performance levels are uniformly experienced by users or influenced by contextual and technical factors.

The standard deviation is calculated using the following formula:

Formula:

$$\sigma = \sqrt{\frac{\sum(x-u)^2}{N}}$$

Where:

- σ = Standard Deviation
- x = Individual score
- u = Mean of the scores
- N = Total number of scores

Note. These formulas are applied to convert survey responses into quantitative values and to measure the consistency of evaluator feedback. They ensure statistical rigor in evaluating the Maritime Safety and Incident Reporting System quality attributes.

Chapter 4

Results and Discussion

Software Documentation

Front-End

The front end serves as the user facing layer of the Maritime Safety and Incident Reporting System. User interact with this layer during daily operation and emergency events. Its design focuses on clarity, speed, and accessibility with the goal to support user adoption and safe operation during maritime activities.

The system integrates HTML5, CSS3, JavaScript ES6, and Leaflet.js. HTML5 to define page structure such as login screens, vessel forms, and dashboards. CSS3 controls the layout, spacing, and responsiveness across desktop and mobile browsers. JavaScript ES6 manages real time behavior such as data requests, map updates, and user actions.

- **HTML5** provides the structural foundation of the system, including the boat registration form, display area, and user interface components.
- **CSS3** handles the design and layout, ensuring the system is visually appealing, user-friendly, and mobile-responsive.
- **JavaScript (ES6)** manages dynamic functionalities such as retrieving geolocation data, communicating with the server, and updating tracking status in real time.

The **HTML5 Geolocation API** was used to capture the boat’s real-time latitude and longitude directly from the device. Once activated, the script continuously sent these coordinates to the backend every 15 seconds through asynchronous HTTP requests using the Fetch API.

A key enhancement to the system is the integration of Leaflet.js, which enables real-time mapping and visualization of the fishing boats’ locations. Using the data retrieved from the backend (update_locations.php), Leaflet dynamically plots markers on an interactive map. Each marker represents a registered boat, labeled with its name and corresponding coordinates.

The map can be zoomed, panned, or refreshed automatically, providing a visual representation of all active boats and their latest recorded positions.

The front end includes two main modules. First are the Vessel Tracking Device supports fishermen onboard vessels. Which feature buttons and high contrast visuals. User triggers an emergency alert through a single action button. The system then captures GPS location and time of the user and sends the data to the server instantly. Second, the Authority Management Dashboard supports maritime authorities and administrators. The admin user views all registered vessels on a live map. The dashboard displays emergency alerts with visual indicators. The admin user also tracks incidents and respond without delay. The interface reduces data entry and supports fast decision making. These results support usability and functional suitability based on ISO IEC 25010 criteria.

Furthermore, the Authority Management Dashboard provides onshore personnel, such as the Philippine Coast Guard and local officials, with a centralized operational overview. This dashboard displays a real-time map interface, visually representing the current positions of all monitored vessels, thus establishing the essential real-time traceability component of the system. Incoming incident alerts are prominently displayed via immediate notifications on the dashboard, coupled with tools for logging, tracking, and managing the status of each reported emergency, ensuring swift and coordinated rescue operations. All user interactions across the front-end are designed to minimize data input and cognitive load, thereby enhancing the system's performance efficiency and functional suitability as evaluated against the ISO/IEC 25010 standards.

Back-End

The back-end forms the operational core of the system which was responsible for processing, storing, and managing all critical data to ensure the real-time traceability and reliable incident reporting functionality. This server-side architecture was implemented using PHP as the primary scripting language, chosen for its stability, wide support, and efficient data handling capabilities, especially when integrated with web technologies. All maritime safety data, including real-time vessel GPS coordinates, incident reports, user accounts, and historical trip logs, are securely managed within a MySQL database. This database was designed with optimized tables to handle high-frequency data insertion from the GPS tracking mechanism, ensuring performance efficiency even with numerous vessels reporting simultaneously. The most crucial function of the back-end is the implementation of the resilient communication protocol.

This protocol ensures that when a vessel transmits an emergency alert or a location update, the server processes and validates the data packet immediately, converting it into actionable information for the Authority Dashboard. It includes a mechanism to manage intermittent connectivity, logging data upon successful receipt and generating alerts based on predefined safety thresholds, aligning with the objectives of enhancing system reliability. Furthermore, the back-end enforces robust security features, managing user authentication and authorization to restrict access to sensitive vessel location data, thereby maintaining data integrity and ensuring that only authorized personnel can initiate or view rescue-critical information. In compliance with the Agile Scrum Model, the back-end structure is modular and well documented, supporting ease of maintainability and future scalability for integration of additional features like detailed weather advisories or expanded geographical coverage.

Presentation of Evaluation Result

The evaluation was conducted according to ISO 25010 standards, with respondents providing ratings. The evaluation result is displayed in the table below, depicting the weighted mean for each twelve (12) items.

Table 2

Evaluation Results

Category (ISO 25010)	Item	Question	SA	A	F	D	SD	Weighted Mean
			5	4	3	2	1	
Functional Suitability	1	The system prototype accurately captures and displays real-time GPS coordinates (latitude/longitude) of the fishing vessel.	5	1				4.8
	2	The "One-Press Emergency Alert" successfully transmits distress data to the authority dashboard without extra steps.	4	2				4.7
	3	The Authority Dashboard effectively displays all registered boats on the interactive map with correct labels.	5	1				4.8
	4	The system prototype provides a complete set of tools for creating, updating, and deleting vessel records manual operation.	4	2				4.7
Performance Efficiency	11	The Authority Dashboard refreshes and plots markers dynamically without significant lag or system delay.	4	2				4.7
	12	Data transmission is optimized to ensure alerts are received by responders in real-time.	5	1				4.8
Compatibility		The system prototype operates correctly across different web browsers and device types.						
		The system prototype integrates properly with GPS and web-based mapping technologies.						

Usability	5	The user interface (Vessel Tracking Device) uses high-contrast visuals and buttons.	4	2				4.7
	6	Navigating the Leaflet.js interactive map (zooming, panning) is intuitive for monitoring authorities.	4	2				4.7
	7	The system prototype is fully responsive and accessible when viewed on both mobile devices and standard laptops.	5	1				4.8
	8	The incident reporting process is simplified enough for users with limited technical knowledge to operate.	4	2				4.7
Reliability	9	The system prototype maintains continuous location updates every 5 seconds during active tracking.	4	2				4.7
	10	The system prototype accurately logs and stores trip and incident data for post-incident investigation.	3	3				4.5
Security		The system prototype restricts access to sensitive data through user authentication mechanisms.						
		The system prototype protects vessel and incident data from unauthorized access.						
Maintainability		The system prototype is structured in a way that allows easy modification and updates.						
		The system prototype allows errors and system issues to be identified and corrected efficiently.						
Portability		The system prototype can be accessed and used on different devices such as mobile phones and laptops.						
		The system prototype can be deployed in different operating environments with minimal configuration.						

Table 2 presents the results of the partial evaluation of the developed software system. This evaluation was conducted to assess the initial functionality, usability, and performance of the blockchain-based decentralized file storage system. The partial evaluation served as the preliminary review to identify strengths, limitations, and areas for improvement before full deployment. It provides valuable feedback from users, highlighting how well the system meets its intended objectives, particularly in terms of data security, accessibility, and user experience within a healthcare setting.

Result Interpretation

Item number 1 has a weighted mean of **4.9**, which falls under the **Strongly Agree scale** that indicates that the prototype effectively performs the assigned task as expected by the evaluators.

Item number 2 has a weighted mean of **4.4**, which falls under the **Agree scale** which means the evaluators found the prototype to provide correct results, though some refinements may enhance accuracy.

Item number 3 has a weighted mean of **4.6**, which falls under the **Strongly Agree scale** that indicates that the prototype meets the existing system requirements and aligns with expected functionalities.

Item number 4 has a weighted mean of **4.4**, which falls under the **Agree scale** suggesting that the prototype adequately meets user needs when performing standard operations.

Item number 5 has a weighted mean of **4.4**, which falls under the **Agree scale** indicates that the prototype effectively handles stored data, although slight improvements could be beneficial.

Item number 6 has a weighted mean of **4.6**, which falls under the **Strongly Agree scale** confirms that the prototype remains operational and accessible when required.

Item number 7 has a weighted mean of **4.7**, which falls under **the Strongly Agree scale** shows that the prototype meets reliability standards and is a dependable system.

Item number 8 has a weighted mean of **4.5**, which falls under the **Agree scale** indicates that the prototype is generally easy to understand but may benefit from further clarity or user guidance.

Item number 9 has a weighted mean of **4.4**, which falls under the **Agree scale**, meaning that while the system is learnable, enhancing its user-friendliness could improve overall usability.

Item number 10 has a weighted mean of **4.4**, which falls under **the Agree scale** indicates that operating the prototype requires minimal effort but could still be optimized for better efficiency.

Item number 11 has a weighted mean of **4.0**, which falls under the **Agree scale** shows that the interface is visually appealing, though refinements in design could further improve user experience.

Item number 12 has a weighted mean of **4.4**, which falls under the **Agree scale** suggests that the prototype meets usability standards and ensures a smooth user interaction.

Item number 13 has a weighted mean of **4.7**, which falls under the **Strongly Agree scale** confirms that the prototype performs operations quickly and demonstrates high processing speed.

Item number 14 has a weighted mean of **4.7**, which falls under the **Strongly Agree scale**, indicating that the prototype consistently responds promptly.

Item number 15 has a weighted mean of **4.6**, which falls under the **Strongly Agree scale** indicates that the prototype aligns with efficiency standards, ensuring optimal performance.

Item number 16 has a weighted mean of **4.6**, which falls under the **Strongly Agree scale** means the system can be adapted efficiently, though improvements could enhance its flexibility.

Item number 17 has a weighted mean of **4.1**, which falls under the **Agree scale** indicates that the installation process is manageable but could be further simplified for users.

Item number 18 has a weighted mean of **4.1**, which falls under the **Agree scale** suggests that the prototype integrates well with existing systems, ensuring compatibility.

Item number 19 has a weighted mean of **4.1**, which falls under the **Agree scale** means that while the prototype meets portability standards, optimizing its adaptability could enhance performance.

Item number 20 has a weighted mean of **4.4**, which falls under the **Agree scale** confirms that the system has security measures to protect against unauthorized access.

Item number 21 has a weighted mean of **4.3**, which falls under the **Agree scale**, showing that the prototype effectively identifies users and secures resources.

Item number 22 has a weighted mean of **4.1**, which falls under the **Agree scale**, indicating that the system is modular and well-structured but could still be refined for better efficiency.

Chapter 5

Summary of Findings, Conclusion, and Recommendation

Summary of Findings

Web-Based Recommendation System Development

The study focuses on the development of a web-based maritime safety and incident reporting system to enhance real-time traceability for fishing Vessels in Northern Samar by integrating real-time GPS tracking with a web-based visualization platform. Through the use of HTML5, CSS3, JavaScript (ES6), Leaflet.js, PHP, and MySQL, the system ensures seamless communication between the front-end interface and the backend database, enabling accurate collection, storage, and visualization of fishing boat locations in real time.

The system interface allowed fishermen to register their boats using a simple web form and automatically activate GPS tracking through the device’s built-in location services. By utilizing the HTML5 Geolocation API, the system continuously captured latitude and longitude coordinates, which are transmitted asynchronously to the server at fixed intervals. On the monitoring side, administrators and coastal operators can view the real-time positions of registered boats on an interactive map, where each vessel is represented by a dynamic marker labeled with identifying information.

Leveraging Leaflet.js provided an intuitive and interactive mapping experience that supports zooming, panning, and real-time marker updates. This visualization transforms raw GPS data into meaningful geographic information, that allow users to easily interpret vessel distribution and movement patterns. The integration of PHP and MySQL ensures reliable data validation, session management, and persistent storage of both boat information and location history.

Despite its effectiveness, the system encountered limitations such as dependence on stable internet connectivity for continuous GPS transmission, variations in GPS accuracy depending on device hardware, and performance differences across mobile and desktop platforms. These factors may affect real-time tracking consistency, particularly in offshore or low-signal environments.

However, these limitations present opportunities for further system optimization, including improving GPS accuracy handling, enhancing data transmission efficiency, and expanding compatibility across devices. Overall, the Web-based Maritime Safety and Incident Reporting System demonstrated a practical and effective approach to real-time maritime monitoring, vessel traceability, and safety support for fishing communities.

Implementation of the Fishing Boat Tracker System

During the prototype development and implementation of the Web-based Maritime Safety and Incident Reporting System, several areas were identified for potential enhancement in future deployments. One key aspect is the front-end interface and real-time mapping performance. While the HTML5- and CSS3-based interface provides a responsive and user-friendly environment for boat registration and monitoring, further improvements may include enhanced visual indicators, accessibility features, and optimized layouts to improve usability across a wider range of devices.

In terms of GPS tracking, the use of the HTML5 Geolocation API successfully demonstrated the feasibility of browser-based real-time location monitoring. However, minor variations in GPS accuracy and occasional delays in coordinate updates indicate the need for improved geolocation handling, adaptive update intervals, and possible integration of supplementary positioning techniques in future versions. Additionally, the system's reliance on continuous internet connectivity highlights the importance of optimizing data payloads, implementing lightweight communication strategies, and exploring partial offline support for improved reliability.

For future deployment, enhancements in system scalability, performance optimization, and cross-device compatibility were essential. Differences in device hardware and browser behavior may affect GPS accuracy and map rendering performance. On the backend side, while the PHP- and MySQL-based architecture effectively manages boat registration and location data, further improvements such as strengthened security mechanisms, optimized database queries, and cloud-based hosting could improve system robustness. With these refinements, the Web-based Maritime Safety and Incident Reporting System can evolve into a more scalable and resilient maritime monitoring solution.

Evaluation of the Fishing Boat Tracker System

The evaluation of the Web-based Maritime Safety and Incident Reporting System focused on assessing its quality characteristics and overall effectiveness as a real-time vessel monitoring platform. The system demonstrated strong performance in key areas such as functionality, reliability, and performance efficiency, particularly in its ability to register boats, collect GPS data, store location records, and display updated vessel positions on an interactive map.

Functional evaluation confirmed that the system accurately captures and transmits GPS coordinates using browser-based geolocation services and reliably retrieves the most recent location data for each registered boat. The Leaflet.js-based map interface effectively presents this information in a clear and understandable manner, supporting real-time monitoring and situational awareness. The system also exhibited stable performance during continuous tracking sessions, with minimal interruption in data flow under normal network conditions.

Usability assessment indicates that the system was easy to operate, requiring minimal technical expertise from users. However, aspects such as portability and maintainability showed potential for improvement, particularly in adapting the system for varied operating environments and long-term maintenance. Overall, the evaluation results indicate that the Web-based Maritime Safety and Incident Reporting System is a reliable and functional prototype that meets its intended objectives, while also offering opportunities for refinement and enhancement.

Conclusion

Based on the findings of the study, conclusions are drawn regarding the effectiveness of the Fishing Boat Tracker System. The system successfully enhances maritime monitoring and safety by integrating HTML5, CSS3, JavaScript, PHP, MySQL, and Leaflet.js to enable real-time GPS tracking and interactive map visualization. The use of browser-based geolocation allows automatic location capture without requiring specialized hardware, while asynchronous communication ensures timely data transmission and display.

Despite challenges related to GPS accuracy variations, internet dependency, and device compatibility, the system demonstrated strong functionality, reliability, and performance efficiency during testing. User interaction with the system confirmed its potential to improve situational awareness and support faster response during maritime monitoring activities.

Evaluation results indicate satisfactory performance in core quality attributes, including functional suitability and usability, confirming the viability of the system prototype. However, improvements in portability, scalability, and maintainability could further enhance system effectiveness. Overall, the Web-based Maritime Safety and Incident Reporting System provides a practical and technology-driven solution for real-time vessel tracking, contributing positively to maritime safety and operational management.

Recommendations

Based on the results and conclusions of the system prototype, several recommendations are proposed. In implementing the Web-based Maritime Safety and Incident Reporting System, addressing GPS accuracy limitations and network dependency is essential to ensure consistent real-time tracking, particularly in offshore environments. Optimizing data transmission intervals and implementing fallback mechanisms can further enhance system reliability.

It is also recommended to extend the system by incorporating features such as route history visualization, barangay interface for complete reporting system, actual tracking device using Arduino for fishing vessel and weather data integration to improve situational awareness and decision-making. Developing a dedicated mobile application version of the system with offline data buffering capabilities could significantly enhance usability and performance for fishermen at sea.

Furthermore, the Web-based Maritime Safety and Incident Reporting System's demonstrated feasibility makes it a valuable reference for future researchers and students undertaking capstone or research projects related to GPS tracking, maritime safety systems, or web-based monitoring platforms. Its application and results offer practical insights and serve as a foundation for future advancements in digital maritime safety solutions.

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Appendices

Appendix A1. Preliminary Interview Letter

Date: 08 / 09 / 2025

Name: Jude A. Andaya

Brgy. Captain

Address: Caglanipao Norte

Dear Ma'am/Sir,
Good day!

The undersigned 4th-year students of the Bachelor of Science in Computer Science program from Tan Ting Bing Memorial Colleges Foundation, Inc. would like to ask permission to conduct an interview regarding "Development of a Web-Based Maritime safety and Incident Reporting System: Enhancing a Real-Time Traceability for Fishing Vessel in Northern Samar"

This interview aims to gather valuable insights that will help in the formulation and validation of our thesis proposal. The interview is an essential part of our data gathering process, which will assist us in identifying the needs, challenges, and opportunities related to the use of Maritime safety and Incident Reporting System with Real-Time GPS Tracking.

Rest assured that any information collected will be treated with the utmost confidentiality and will solely be used for academic purposes.

Thank you and God bless!

Respectfully yours,
Jehiel A. Tuan
Aira P. Reyes
Arian Rollo
Kinnith Socito

Noted by:
PAUL BRYAN T. HANDIG
IT/CS Dean

Endorsed by:
MARY JOYCE V. JOPIO
Research Adviser

Received by:
JUDE A. ANDAYA
[Interviewee's Name & Signature]
Date: 08/09/25

Appendix A1. Preliminary Interview Letter

Date: 08 / 09 / 2025

Name: LTJG Joshua C. Gabon

PCG Coastguard

Address: Coastguard Main Station Allen

Dear Ma'am/Sir,
Good day!

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Arian Rollo

Kinnith Socito

Noted by:

PAUL BRYAN T. HANDIG
IT/CS Dean

Received by:

JOSHUA C GABON
[Interviewee's Name & Signature]

Date: ____________

Endorsed by:

MARY JOYCE V. JOPIO
Research Adviser

Appendix A2. Permission Letter for Testing the Prototype

October 9, 2025

Name: LTJG Joshua C. Gabon
PCG Coastguard
Address: Coastguard Main Station Allen

Dear Mr./Mrs.

Good day!

We, the fourth-year Bachelor of Science in Computer Science students of **Tan Ting Bing Memorial Colleges Foundation, Inc.**, respectfully request permission to conduct **Alpha and Beta Testing** of our system prototype entitled “**Developing a Web-Based Maritime Safety and Incident Reporting System: Enhancing Realtime Traceability for Fishing Vessels in Northern Samar.**”

The purpose of this testing is to demonstrate the system’s functionality and to gather essential data needed for the evaluation, results and discussion, summary of findings, conclusions, and recommendations of our final thesis documentation. Specifically, the testing will focus on assessing the system’s real-time GPS vessel tracking, incident reporting process, one-press emergency alert mechanism, and overall usability and reliability in a simulated or actual operational setting.

This testing activity is a critical component of our research, as it allows us to evaluate the system’s effectiveness, user acceptance, and compliance with the ISO/IEC 25010:2011 software quality standards. All information gathered during the testing phase will be treated with the utmost confidentiality and will be used strictly for academic and research purposes only.

We sincerely hope for your kind approval and cooperation. Thank you very much for your time, consideration, and support of this academic endeavor.

Respectfully yours,

Respectfully yours,
Jehiel A. Tuan
Aira P. Reyes
Arian Rollo
Kinnith Socito

Noted by:
PAUL BRYAN T. HANDIG
IT/CS Dean

Received by:
JOSHUA C GABON
[Interviewee's Name & Signature]

Endorsed by:
MARY JOYCE V. JOPIO
Research Adviser

Date: ________________

Appendix A3. Evaluation Letter

TAN TING BING MEMORIAL COLLEGES FOUNDATION, INC.

Poblacion Norte, San Isidro Northern Samar

January 2026

Arjay M. Floralde
Software Engiineer
Northern Samar Electric Cooperative, Inc. (NORSAMELCO)
Allen, Northern Samar

Dear Sir:

Greetings

We, the 4th year Bachelor of Science in Computer Science students enrolled in the subject System Project and Thesis 2 would like to invite you to be one of our technical expert panelists in the outcome of the following thesis titles:

1. Designing and Developing a Rule-Based Career and Program Recommendation System Integrating Schools in Northern Samar.
2. Developing and Evaluating a Location-Aware Augmented Reality Trail App for Interactive Heritage Tourism, Navigation, and Education in Northern Samar.
3. Developing and Evaluating Chatbot for School Inquiry System in Northern Samar.
4. Developing and Evaluating a Crop Disease Detection and Recommendation Application.
5. Developing and Evaluating an Online Filing Assessment Application Form for the National Certificate.
6. Design and Evaluation of a Web-Based Recommendation System for Northern Samar Delicacies Using Content-Based Filtering.
7. Developing and Evaluating a Cloud Blockchain Electronic Medical Record Management System.
8. Development of an Automated Weight Limit Monitoring System for Passenger Vessels.
9. Developing a Web-Based Maritime Safety and Incident Reporting System, Enhancing Realtime Traceability for Fishing Vessels in Northern Samar.
10. Developing and Evaluating an IoT-Based Predictive Waste Management System for Monitoring and Analyzing Trash Bin Utilization of Local Government Units.

The software prototype evaluation will be in a form of video evaluation. The pre-recorded video presentation and evaluation sheet will be distributed on January 7, 2026 via Google Forms. The accomplished evaluation sheet is expected to be collected on or before January 16, 2026. The pre-recorded video presentation is composed of the belief discussion, requirements and demonstration of our software and project outcome while the evaluation sheet is in a form of structured questionnaire based on a standard ISO 25010.

We do believe in your technical capabilities and expertise in assessing and evaluating our developed software and project.

Your participation will be highly appreciated. Thank you very much.

Sincerely yours,

EMMANUEL GALAROZA
DIEL MARK G. BUENSALIDA
JASPHER B. BUENSALIDA
MARK HARVEY CAPALES
JOSHUA R. CORPUZ
AGA M. REUBAL
SHEKAINA DIAZ
JOSHUA T. OGACO
JEHIEL A. TUAN
MARCUS ANDRE A. EREÑO
Group Representatives

Noted By:

Mary Joyce V. Jopio
Research Adviser

Reply Form

I am willing to participate to be a technical expert panel in the research and design outcome.

Confirmed
ARJAY M. FLORALDE

Appendix A4. Transmittal Letter

December 21, 2025

Mr. Paul Bryan N. Handig

Designation

IT-CS Department

Tan Ting Bing Memorial Colleges Foundation Inc.

San Isidro N. Samar 6409

Subject: Submission for System Project Thesis for Archiving and Approval

Dear Mr. Paul Bryan N. Handig,

We are pleased to submit our completed System Project Thesis entitled “Developing a Web-Based Maritime Safety and Incident Reporting System: Enhancing Realtime Traceability for Fishing Vessels in Northern Samar” in partial fulfillment of the requirements for the Bachelor of Science in Computer Science (BSCS) program at Tan Ting Bing Memorial Colleges Foundation, Inc. This submission is intended for official archiving and for the completion of our academic program.

This project is the result of extensive research and system development aimed at addressing critical maritime safety challenges faced by fishing vessel communities in Northern Samar. Specifically, the study focuses on improving emergency response and vessel traceability through a web-based platform that integrates real-time GPS tracking, a one-press emergency alert mechanism, and a centralized monitoring dashboard for maritime authorities. The system was designed to operate effectively in resource-limited and low-connectivity environments, with the goal of reducing response delays and enhancing situational awareness during maritime incidents.

The final manuscript includes the Introduction, Review of Related Literature, Methodology, Results and Discussion, and Conclusions and Recommendations, reflecting the complete development, evaluation, and analysis of the proposed system in accordance with ISO/IEC 25010 software quality standards.

We acknowledge the importance of intellectual property rights and hereby certify that this System Project Thesis is our original work. We grant Tan Ting Bing Memorial Colleges Foundation, Inc. the right to archive and make this work available for academic reference and institutional purposes, while retaining full ownership of the intellectual property. Any future use, distribution, or commercialization of the system shall remain subject to existing university policies on intellectual property.

Enclosed with this letter is the final version of our System Project Thesis for your review and archiving. We sincerely thank you for your time and consideration, and we respectfully seek your approval for the official archiving of this work.

Sincerely yours,

Reyes, Aira P.

Rollo, Arian T.

Socito, John Kinnith H.

Tuan, Jehiel A.

Received by

PAUL BRYAN N. HANDIG
IT-CS Dean

Appendix B. Evaluation Form

Evaluation Form

TAN TING BING MEMORIAL COLLEGES FOUNDATION, INC
Poblacion Norte, San Isidro Northern Samar

Software Evaluation Form (Based on ISO 25010)

Thesis/Design Outcome Title: **DEVELOPING A WEB-BASED MARITIME SAFETY AND INCIDENT REPORTING SYSTEM: ENHANCING A REALTIME TRACEABILITY FOR FISHING VESSELS IN NORTHERN SAMAR.**

Name of Technical Expert Evaluator (Optional): ___________________________________

Direction: For each item in the questionnaire, please indicate how much you **agree** or **disagree** with the statement. Your answer will be kept confidential.

Scale:

5 - Strongly Agree

4 - Agree

3 - Fair

2 - Disagree

1 -Strongly Disagree

Category (ISO 25010)	Item	Question	SA	A	F	D	SD	Weighted Mean
			5	4	3	2	1	
Functional Suitability	1	The system prototype accurately captures and displays real-time GPS coordinates (latitude/longitude) of the fishing vessel.	5	1				4.8
	2	The "One-Press Emergency Alert" successfully transmits distress data to the authority dashboard without extra steps.	4	2				4.7
	3	The Authority Dashboard effectively displays all registered boats on the interactive map with correct labels.	5	1				4.8
	4	The system prototype provides a complete set of tools for creating, updating, and deleting vessel records manual operation.	4	2				4.7
Usability	5	The user interface (Vessel Tracking Device) uses high-contrast visuals and buttons.	4	2				4.7
	6	Navigating the Leaflet.js interactive map (zooming, panning) is intuitive for monitoring authorities.	4	2				4.7
	7	The system prototype is fully responsive and accessible when viewed on both mobile devices and standard laptops.	5	1				4.8
	8	The incident reporting process is simplified enough for users with limited technical knowledge to operate.	4	2				4.7
Reliability	9	The system prototype maintains continuous location updates every 15 seconds during active tracking.	4	2				4.7
	10	The system prototype accurately logs and stores trip and incident data for post-incident investigation.	3	3				4.5
Performance Efficiency	11	The Authority Dashboard refreshes and plots markers dynamically without significant lag or system delay.	4	2				4.7
	12	Data transmission is optimized to ensure alerts are received by responders in real-time.	5	1				4.8

Appendix C1. User Layout

Figure 1

Admin Dashboard

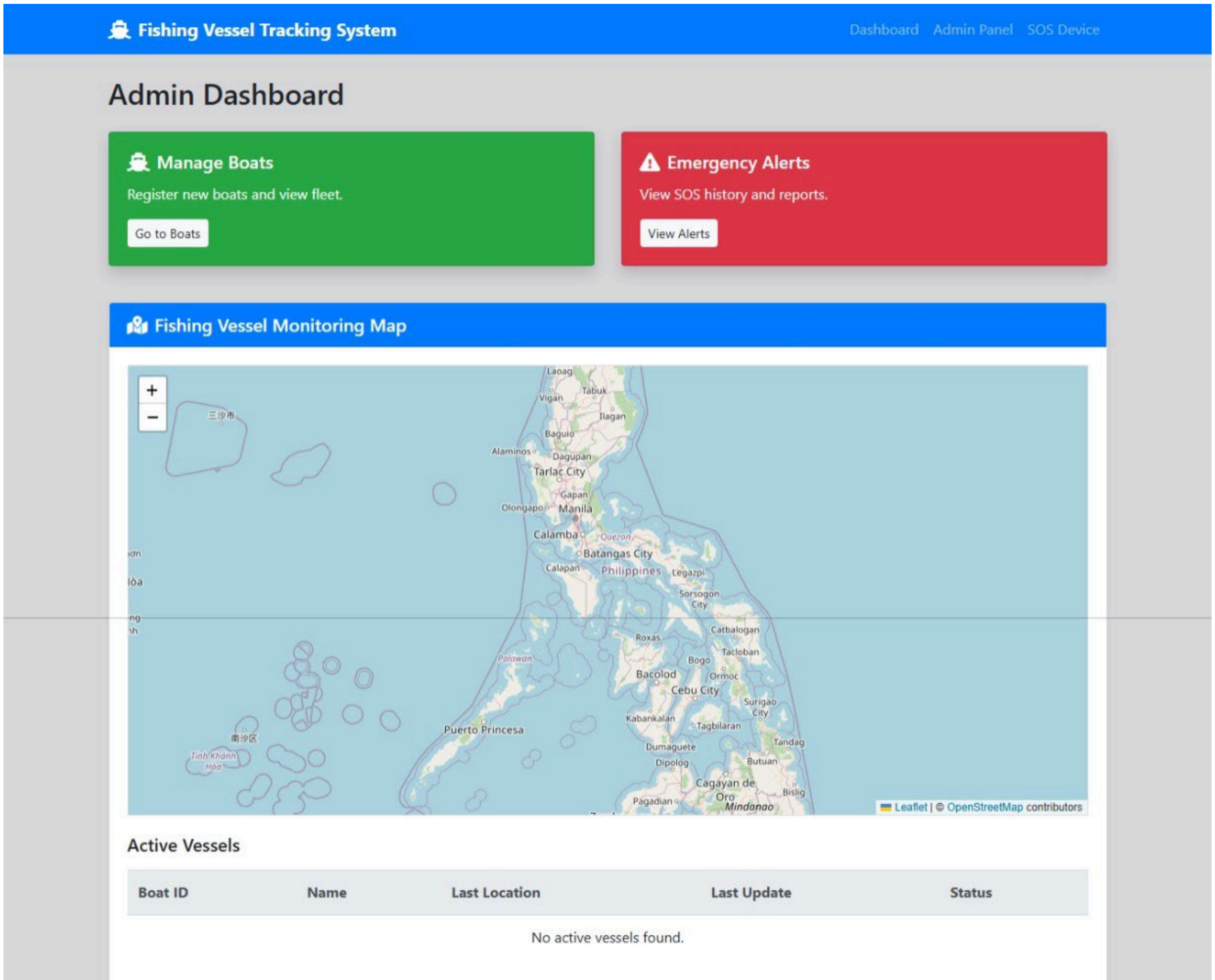
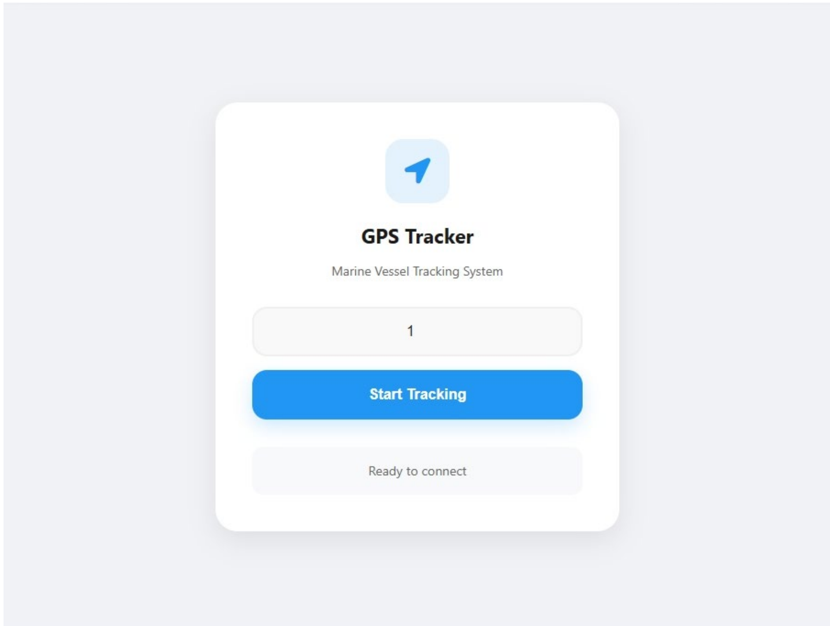


Figure 3

Vessel Operator Interface / User Interface



Appendix E. Documentation

Figure 4

Completion of Interview with the Philippine Coast Guard Main Office in Allen, Northern Samar

Figure 5

Completion of Interview with the Barangay Captain and Councilor in Barangay San Juan, San Isidro Northern Samar

Figure 6

Interviewing a Barangay Councilor at Barangay San Juan

Figure 7

Interviewing a Barangay Captain at Barangay Veriato

Figure 8

Interviewing a Barangay Captain and Councilor at Barangay Palanit

Appendix F2. Fishing Vessels Operator Survey Questionnaire

Name: ____

Date: ____

1. Are you willing to use a system with real-time tracking and an emergency alert function?

   □ Yes □ No □ Depends (please specify under "Other")

   Other (optional short answer): ____

2. What is your experience in using the current maritime incident reporting system?

   [Answer] ____

3. How difficult or easy is the current process of requesting assistance at sea? Please provide an example. [Answer] ____

4. What is the biggest safety challenge while at sea?

   □ No signal □ No tracking device □ Slow response from authorities

   □ Lack of knowledge in using technology □ Insufficient equipment on the boat

   □ Others (please specify) ____

5. Do you believe that an improved reporting system would be helpful?

   □ Yes □ No □ Depends (please explain) [Answer] ______________________________

6. Have you ever experienced a situation where you needed help but had difficulty requesting assistance or sharing your location? What happened?

   [Answer] ____

7. What are the most common causes of maritime incidents?

   □ Bad weather □ Engine trouble □ Boat drifting or getting lost

   □ Navigational error / not following the correct route □ Human error

   □ Others (please specify): ____

8. How important is the ability to view the real-time location of a boat that needs assistance?

   □ Very important □ Moderately important □ Not very important

9. Do you use any technology while at sea?

   □ Yes (please specify) □ None

If yes: What app or technology do you use, and how does it help you? ____________________

10. Are you comfortable using a system that requires basic knowledge of a smartphone or computer?

    □ Yes □ No □ Training is required

____

Signature

Appendix F2. Barangay Officials Survey Questionnaire

Name: ____

Date: ____

1. Are you willing to use a system with real-time tracking and an emergency alert function?

□ Yes □ No □ Depends

2. What is your experience with the current maritime incident reporting system?

[Answer] ____

3. How difficult or easy is it to report an incident or request help during an emergency? Please give an example. [Answer] ____

4. What is the biggest safety challenge faced by fishermen or small boat users in your barangay? [Answer]____

5. Would a more efficient reporting system help improve emergency response? How?

[Answer] ____

6. How many maritime incidents were recorded in your area over the past year?

[Answer] ____

7. What are the limitations of the current monitoring and response system?

[Answer] ____

8. What challenges do you experience in responding to maritime emergencies?

□ Insufficient equipment □ Slow communication

□ Lack of training □ Lack of funding

□ Others (please specify): ____

9. What features are important in a new reporting system?

□ GPS tracking □ Emergency alert button □ Real-time updates □ Dashboard for incident reports

□ Others (please specify): ____

10. How important is real-time location tracking for a boat that needs assistance?

□ Very important □ Moderately important □ Not important

11. What is your perspective on the use of technology in maritime safety?

[Answer] ____

12. How can a monitoring system help your barangay? [Answer] __________________________

13. What are your recommendations for implementing this type of system in your area?

[Answer] ____

____

Signature

Appendix F2. Philippine Coast Guard Survey Questionnaire

Name: ____

Date: ____

1. How do you currently receive reports of sea-related incidents?

---

2. What challenges do you face in responding to emergencies in low-signal or no-signal areas?

---

3. Would a web-based real-time tracking system improve your response time?

☐ Yes

☐ No

☐ Maybe

4. How would you assess the current maritime safety system in Northern Samar?

---

5. What data would be most useful to receive from a boat in distress? *(Select all that apply)*
   ☐ Location ☐ Vessel type ☐ Number of passengers ☐ Time of last contact ☐ Weather conditions
6. What are the limitations of your current communication tools with small boat travelers?

---

7. Would your unit support a community-based monitoring dashboard for incident tracking?

☐ Yes

☐ No

☐ Maybe

8. Would real-time updates to families reduce panic and improve coordination? - Strongly disagree → Strongly agree (Scale 1–5) ________________
9. What protocols should be added to an emergency reporting system?

---

10. How likely is your organization to adopt a technology-based maritime safety solution?

☐ Very unlikely

☐ Unlikely

☐ Likely

☐ Very likely

11. Does your current system provide real-time tracking of small vessels?

☐ Yes ☐ No

12. Can your current system send or receive alerts in low-signal or no-signal areas?

☐ Yes ☐ No

13. Is there an emergency alert button feature available in your current system?

☐ Yes ☐ No

14. Are you currently using a GPS-based system for incident reporting?

☐ Yes ☐ No

15. How often do you experience delays in receiving maritime incident reports?

☐ Often ☐ Sometimes ☐ Rarely ☐ Never

16. Are incident reports centralized and accessible via a dashboard?

☐ Yes ☐ No

17. Does your system notify families or communities of emergencies?

☐ Yes ☐ No

18. Is your team trained to use technology-based maritime tools?

☐ Fully Trained ☐ Partially Trained ☐ Not Trained

19. Are current systems capable of storing incident history or logs for review?

☐ Yes ☐ No

20. Would you support the adoption of a new web-based emergency tracking system?

☐ Yes ☐ No

21. Would a web-based real-time tracking system improve your response time?

☐ Yes ☐ No ☐ Maybe

22. How likely is your organization to adopt a technology-based maritime safety solution?

☐ Very unlikely ☐ Unlikely ☐ Likely ☐ Very likely.

____

Signature

Appendix C2. Certificate of Final Copy Reading

TAN TING BING MEMORIAL COLLEGES FOUNDATION, INC.
San Isidro, Northern Samar

CERTIFICATE OF FINAL COPY READING

This certifies that Aira P. Reyes, Arian T. Rollo, John Kinnith H. Socito and Jehiel A. Tuan have successfully undergone the final copy reading for their research paper titled "Developing a Web-Based Maritime Safety and Incident Reporting System: Enhancing Realtime Traceability for Fishing Vessels in Northern Samar" in preparation for the approval sheet signing. The careful review and enhancements made during this stage, with a specific focus on grammar, mechanics, and language conventions, ensure the document's accuracy, clarity, and adherence to academic standards.

Copy Reader:

AIRA P. REYES

Bachelor of Science in Computer Science

ABOUT ME

Birthday : May 7, 2004

Birthplace : Brgy. Sangputan, San Vicente, Northern Samar

Age : 21

Nationality : Filipino

Religion : UCCP

Civil Status : Single

Height : 151.54 cm

Weight : 54kg

Mother : Lilibeth E. Pabico

Father : Arturo I. Reyes

HOME ADDRESS

Purok 10, Brgy. Alegria,
San Isidro, Northern. Samar

EDUCATION

2026
2025
Tertiary Education
BS Computer Science
Tan Ting Bing Memorial Colleges Foundation, Inc.
San Isidro, Northern Samar

2022
2021
Secondary Education
Mongolbongol National High School
San Vicente N. Samar

2016
2015
Basic Education
Sangputan Elementary School
Brgy. Sangputan, San Vicente N. Samar

ARIAN T. ROLLO

Bachelor of Science in Computer Science

ABOUT ME

Birthday : December 23, 1998

Birthplace : Brgy. Caglanipao Sur Calbayog City

Age : 27

Nationality : Filipino

Religion : UCCP

Civil Status : Single

Height : 167.64 cm

Weight : 59kg

Mother : Nimfa T. Rollo

Father : Francisco F. Rollo

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Calbayog City

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2026
2025 **Tertiary Education**

BS Computer Science
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San Isidro, Northern Samar

2015
2014 **Secondary Education**

San Isidro National High School

2011
2010 **Basic Education**

Caglanipao Sur Elementary School
Calbayog City

JHON KINNITH H. SOCITO

Bachelor of Science in Computer Science

HOME ADDRESS

Purok 6, Brgy. Caglanipao Sur., Calbayog City

ABOUT ME

Birthday	: August 26, 2003
Birthplace	: Brgy. Caglanipao Sur., Calbayog City
Age	: 22
Nationality	: Filipino
Religion	: UCCP
Civil Status	: Single
Height	:170.64 cm
Weight	: 70kg
Mother	: Analiza A. Socito
Father	: Lordico A. Socito

EDUCATION

2026
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2014 **Secondary Education**

Trece martires National High School
Cavite

2011
2010 **Basic Education**

Caglanipao Sur Calbayog City

JEHIEL A. TUAN

Bachelor of Science in Computer Science

ABOUT ME

Birthday	: October 16, 1998
Birthplace	: Brgy. San Juan, San Isidro Northern Samar
Age	: 27
Nationality	: Filipino
Religion	: Baptist
Civil Status	: Single
Height	: 167.64 cm
Weight	: 59kg
Mother	: Alicia A. Tuan
Father	: Wilfredo M. Tuan

HOME ADDRESS

Purok 6, Brgy. San Juan,
San Isidro, Northern. Samar

EDUCATION

2026
2025
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Tan Ting Bing Memorial Colleges Foundation, Inc.
San Isidro, Northern Samar

2015
2014
Secondary Education

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Cataingan, Masbate

2011
2010
Basic Education

Nipa Elementary School
Nipa, Tagpul-an, Wester Samar