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Development of an Online Fire Incident Reporting System for Enhanced Fire Safety in Island

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Abstract:
The Development of an Online Fire Incident Reporting System for Enhanced Fire Safety in Island is an automated platform developed to improve fire incident reporting and management in Island. The system addresses delays and inefficiencies associated with manual reporting processes by enabling real-time incident submission, automated notifications to fire authorities, and centralized storage of incident records. The system was developed using the Agile Development Model and evaluated by information technology experts using the ISO/IEC 25010:2011 Software Quality Model. Evaluation results yielded an overall mean rating, Which indicates a high level of compliance with software quality standards in terms of functional suitability, reliability, usability, and maintainability. The findings demonstrate that the system is effective in supporting timely fire incident reporting and enhancing emergency response coordination in the community.

Keywords: Online fire Reporting System, Fire Safety Management, Public Safety

1. Introduction

Fire safety in remote location, such as Bantayan Island, encounter several challenges due to inadequate infrastructure and slow emergency response times. The lack of real time communication between residents and fire departments often results in delayed responses and greater damage, as isolated communities struggle with insufficient resources, complicating local authorities ability to manage emergencies effectively [1]. Furthermore, limited fire safety education in rural regions contributes to residents unawareness regarding fire prevention and emergency reporting procedures [2]. This problem is exacerbated by the lack of trained personnel, which obstructs effective firefighting efforts [9], while outdated equipment and inadequate technology further hinder the efficiency of local fire services [10]. Studies show that these systems close communication gaps in rural areas, minimizing delays in emergency response [3]. Online fire reporting system are increasingly recognized as essential tools for enhancing emergency response and fire safety management, especially in remote or underserved communities, by facilitating real time communication between citizens and authorities, which boosts response efficiency and resource allocation [4]. Online reporting platform empower communities by providing direct access to emergency tools, increasing public engagement in fire safety [5].

1.1 Objective of the study

The primary goal of this research was to develop and evaluate the **Bantayan Online Report System** to streamline incident management and community reporting.

Specifically, the study sought to achieve the following:

1. Display on the dashboard the following:
a. Total of Control Teams
b. Total of Pending Requests
c. Total of Assigned Requests
d. Total of Team OTW Requests
e. Total of On-Progress Requests
f. Total of Completed Requests
2. Provide an option for the admin to:
a. Create, Read, Update, and Delete the Details report.
3. General Reports:
a. Print Daily Report
4. Provide option for the users to:
a. Report Incident
b. View Incident
c. About us
d. Citizen's Charter
e. Safety Tips
f. Upcoming Events
5. Determine the quality of the developed system based on ISO/IEC 25010:2011 Systems and Software Quality Requirements and Evaluation (SQuaRE) Quality Model
6. Determine the usability of the developed system based on the following criteria:

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A) Usefulness;
B) Satisfaction;
C) Ease of the Use and Learning;

2. Methods

This research employed a descriptive and action research design, utilizing an iterative model approach. The study on analyzing and resolving communication inefficiencies within the fire reporting system on Bantayan Island.

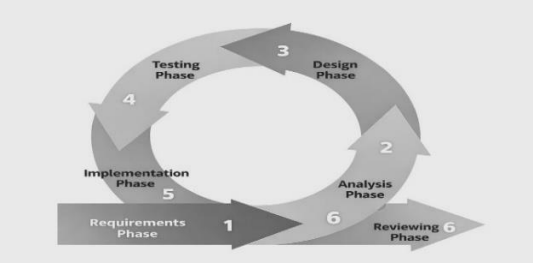

Fig.1 Agile Development Model

Phase 1. Requirement

The requirements phase involved identifying and validating the functional and non-functional needs of the proposed system through coordination with the intended beneficiaries. Site visits were conducted in the municipalities of Bantayan, Madridejos, and Santa Fe to obtain formal approval, collect relevant documents, and consult with fire department personnel regarding existing reporting processes. Based on the gathered information, functional requirements such as real-time fire incident reporting, incident status monitoring, secure user authentication, and dissemination of fire safety information were defined, while non-functional requirements focused on system usability, accessibility, and compatibility with available hardware and software environments. These requirements guided the subsequent stages of system development.

Phase 2. Analysis

In this phase, the project team conducted an extensive analysis of several critical components, including data requirements, UI/UX design, data security, data security, data storage and management, forms, data reports, and documentation.

Phase 3. Design

During the design phase, the project team utilized a Data Flow Diagram (DFD) to map out the transitions and relationship between various data elements within the fire report system, ensuring accuracy and alignment with all specified requirements. This diagram served as a crucial reference throughout the development phase, where programming languages such as PHP and JavaScript were employed for implementation.

Additionally, a wireframe or prototype interface was developed to gather feedback and guide the selection of tools for both front-end and back-end components. The system was design to be accessible on both web and mobile platforms, with secure log in, fast search functions, and streamlined check-out/check-in process.

The development team used a Data Flow Diagram (DFD) to map data movement, ensuring accuracy and directing the coding phase.

Phase 4. Testing

The team designed a survey questionnaire, validated by experts, to ensure that each component of the Bantayan Online Fire System, such as functionality, usability, reliability, portability, and maintainability, meets the specified requirements.

Additionally, to reliability, the questionnaire was tested using Cronbach's alpha to confirm consistency before distributing.

The evaluation took place in Evaluators reviewed each item in the survey to ensure that the system met all specified requirements for reporting accuracy, reliability, and usability.

Phase 5. Implementation

The team, in collaboration with the IT department and bfp administrative of the fire service, identified and prepared all necessary software components for deploying the online fire report system on a secure server located in the IT room.

The system architecture includes a web-based interface for citizens to report fires, a backend server for data processing, and send notification to fire department personnel. Data flow from the front end, where reports are

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submitted, to the backend, where it is stored, analyzed, and acted upon. Once the setup was completed, authorized users were granted access to the online fire report system.

Phase 6. Review

The team prepared necessary monitoring tools to evaluate the system's performance after deployment, ensuring that the online fire reporting system operates smoothly and securely. The team monitored the system performance for one month as part of the agreed review period to promptly address any errors or issues and both functional testing (to protect sensitive user data). Once the system passes testing, it is deployed for live use, with ongoing monitoring and maintenance to ensure reliable operation. This includes collecting user feedback making necessary updates, and ensuring that fire department personnel can respond to incidents effectively. In case of changes or the addition of new features, the team and fire department representatives will collaborate to define new requirements or extend the project timeline as needed to ensure the system remains effective and user-friendly.

Fig. 2 The Bantayan Online Fire Reporting Dashboard

Figure 2 display the total numbers of control teams, pending request, assign request, team OTW request, on progress request, completed request.

3. Results

Table 1. In term of displaying dashboard

CRITERIA	CRITERIA	VERBAL INTERPRETATION
How Functional is our system in terms of control teams in the dashboard?	**4.00**	Functional
How Functional is our system in terms of displaying the total numbers of pending request in the dashboard?	**3.67**	Functional
How Function is our system in terms of displaying the total numbers of Assigned request in the dashboard?	**4.00**	Functional
How Function is our system in terms of displaying the total numbers of team OTW requests in the dashboard?	**4.33**	Strongly Functional
How Function is our system in terms of displaying the total numbers of on-progress request in the dashboard?	**4.00**	Functional
How Function is our system in terms of displaying the total numbers of completed requests in the dashboard?	**4.00**	Functional
TOTAL	**4.00**	**Functional**

Table 1 indicate that the system's dashboard display is highly effective, achieving an overall weighted mean of 4.00, which translates to a verbal interpretation of Functional. Across all specific criteria including the management of control teams and the tracking of pending, assigned, on-progress, and completed requests the system consistently met functional standards. Notably, the tracking of OTW requests received the highest individual rating of 4.33, categorized as Strongly Functional. These findings suggest that the dashboard successfully provides users with clear, actionable data visibility, ensuring that all core tracking features are operating reliably to support system operations.

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Table 2. In term of admin Creating, Reading, Updating, and Deleting Reports.

Criteria	Mean	Verbal Interpretation
How functional is our system in terms of providing an options for the admin to creating details reports?	**4.33**	Strongly Functional
How functional is our system in terms of providing an options for the admin to reading details reports?	**4.67**	Strongly Functional
How functional is our system in terms of providing an options for the admin to updating details reports?	**4.33**	Strongly Functional
How functional is our system in terms of providing an options for the admin to deleting details reports?	**4.00**	Functional
Total	**4.13**	**Slightly Satisfaction**

Table 2 the system demonstrates high performance in managing administrative report functions, specifically in the areas of creating, reading, updating, and deleting (CRUD) details reports. The functionality for reading reports received the highest score with a mean of 4.67, while creating and updating both followed with strong scores of 4.33, all of which were verbally interpreted as Strongly Functional. Although the deletion feature was rated slightly lower with a mean of 4.00 Functional, the overall total mean for these administrative tasks reached 4.13, resulting in a general verbal interpretation of Slightly Satisfaction.

Table 3. In term of generating reports.

Criteria	Mean	Verbal Interpretation
How function is our system in terms of printing daily reports?	**4.00**	Functional
Total	**4.00**	**Slightly Satisfaction**

Table 3 indicates that the system is highly effective in managing and generating administrative reports, with an overall performance level categorized as Slightly Satisfaction across both categories. This table specifically evaluates the printing of daily reports, which received a mean score of 4.00, maintaining a consistent Functional interpretation. Together, these results suggest that the system provides a reliable and user-satisfactory experience for administrative data handling and report output.

Table 4. In term of providing options for the users.

CRITERIA	CRITERIA	VERBAL INTERPRETATION
How Functional is our system in terms of providing options for the users to report incidents?	**4.33**	Strongly Functional
How Functional is our system in terms of providing options for the users to view their system?	**4.00**	Functional
How Functional is our system in terms of providing options for the users to view the About Us page?	**4.00**	Functional
How Functional is our system in terms of providing options for the users to view the citizens?	**4.00**	Functional
How Functional is our system in terms of providing options for the users to view the safety tips page?	**4.00**	Functional
How Functional is our system in terms of providing options for the users to view the upcoming event page?	**4.00**	Functional
How Function is our mobile application?	**3.00**	Functional
TOTAL	**3.00**	**Functional**

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Regarding user accessibility, providing options for reporting incidents was a standout feature with a 4.33 mean (Strongly Functional), though the mobile application and overall user options received a slightly lower total mean of 3.00 while still maintaining a Functional status.

Table 5. In term of the characteristics of a Software or Product as based on ISO/IEC Software Quality Model.

Criteria	Mean	Verbal Interpretation
Functional Suitability	**4.33**	Slightly Satisfaction
Performance Efficiency	**4.22**	Slightly Satisfaction
Compatibility	**4.29**	Slightly Satisfaction
Reliability	**4.22**	Slightly Satisfaction
Security	**4.22**	Slightly Satisfaction
Total	**4.24**	**Slightly Satisfaction**

Table 5 presents the evaluation results of the system based on individual usability criteria, including usefulness, ease of use, ease of learning, and user satisfaction. The findings show that all criteria obtained high mean scores, indicating positive user responses. Among the criteria, usefulness and satisfaction received the highest ratings, suggesting that users found the system helpful and were generally satisfied with its performance. The results imply that the system effectively supports user tasks and meets their expectations in terms of functionality and usability.

Table 6. In term of the usefulness, satisfaction, and ease of use.

Criteria	Mean	Verbal Interpretation
Usefulness	**4.33**	Agree
Ease of use	**4.27**	Agree
Ease of Learning	**4.25**	Agree
Satisfaction	**4.33**	Agree
Total	**4.30**	**Agree**

Table 6 summarizes the overall usability evaluation of the system. The computed overall mean score of 4.30, with a verbal interpretation of Agree, indicates that users generally agreed that the system is usable and effective. This overall result confirms that the system performed well across all evaluated criteria, reflecting a positive acceptance level among users. The findings demonstrate that the system is easy to use, easy to learn, and satisfactory for its intended purpose.

4. Discussion

The following are the detailed presentation, discussions, interpretation, and analysis of research findings:

1. In term of the dashboard design, among the different numbers being displayed, the total number od pending requests was only rated with the lowest score of 3.67, it is because the current dashboard design lacks clarity and prioritization, making it difficult to manage tasks efficiently and respond promptly to high priority requests.
2. In term of creating, reading, updating, and deleting foe the admin, the functionality about deleting details report was only rated with lowest score 4.00, it is because the current deletion functionality lacks Safeguard like a confirmation dialog and an undo option, increasing the risk of accidental deletions and reducing user confidence.
3. In term of providing options for the users, the functionality of mobile application was only rated with the lowest score 3.00, it is because the current mobile application lacks optimization for responsiveness across various devices, resulting in inconsistent performance and navigation issues that reduce usability and user satisfaction.
4. In term of the characteristic set in ISO 25010, the performance efficiency, reliability, and security were only rated with the lowest score of 4.22, it is because the current system may have limitations in performance efficiency, reliability, and security, which could affect resource usage, load handling, and data protection, making it essential to optimize these aspects in accordance with ISO/IEC 25010 standards for software quality.
5. In term of Usefulness, Ease of Use, Ease of learning, and Satisfaction, the ease of learning was only rated with lowest score 4.25, it is because the current system lacks sufficient support for new users, making it challenging for them to quickly learn and navigate the platform, contextual help features, and onboarding walkthroughs.

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5. Conclusion

This study developed and evaluated the Bantayan Online Fire Report System to support efficient fire incident reporting and management for the Bantayan Fire Department. This system offers advantages such as quicker response times, enhanced accuracy of information, and a decrease in the workload for emergency services[6]. This aim many international organizations and platforms have been established that provide the exchange of information, experiences, knowledge, and practice in the field of fire protection [7].

In this paper, a Location Based Smart Fire Reporting system capable of eliminating human involvement is proposed [8]. Evaluation results showed a high level of acceptability, with an overall mean score of 4.08, indicating strong performance in usability, reliability, security, and functionality, as well as ease of learning for users.

Despite the positive results, areas for improvement were identified, particularly in dashboard clarity, request prioritization, and safeguards for critical actions such as report deletion. Overall, the system proved to be an effective tool for improving fire report management and community safety, and future enhancements may focus on improving interface design, strengthening system safeguards, and expanding mobile application functionality to address evolving operational needs.

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