

Bantayan 911: A Centralized Emergency Response and Citizen Engagement System for Bantayan Island

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Abstract:

Bantayan Island's Centralized Emergency Response and Citizen Engagement System. Due to disjointed communication networks, poor interagency coordination, and the lack of centralized reporting procedures, geographically isolated places sometimes face delays in emergency response management. The effectiveness of emergency response activities is greatly impacted by these difficulties, especially in island communities where access to supplies, dependable communication infrastructure, and transportation is frequently restricted. Delays in reporting events and sending out responses in these situations can make emergencies more serious and put locals at more danger. Therefore, enhancing public safety and reducing reaction times in emergency circumstances require the implementation of efficient emergency management systems and integrated disaster preparedness programs. Due to its continuous reliance on manual reporting processes and conventional communication channels, Bantayan Island in Cebu, Philippines, which is made up of the municipalities of Bantayan, Madridejos, and Santa Fe, faces comparable challenges in handling emergency situations.

Keywords — Emergency Response System, Citizen Engagement, ISO 25010, Agile Methodology, Public Safety, Local Government System.

I. INTRODUCTION

An emergency response is a prompt and organized procedure taken when an unexpected or

hazardous event occurs [1]. The primary objective is to reduce or control the potential harm to individuals, property, and the surrounding

environment [2]. Common emergencies that require responses are typhoon, extreme weather, floods, hurricanes, earthquakes, volcanic eruptions, landslides, and droughts. Other emergency situations are caused by human errors such as fire, and crimes [3].

Bantayan Island is situated in the northernmost part of Central Visayas, far from quick response organizations and highly trained personnel. When emergency situations arise, it takes time for a help or response to arrive [4].

This study proposes for the design and development of a centralized digital platform that allows residents to report emergencies in real time while enabling administrators and responders to effectively coordinate operations [5]. Agile Methodology is being used in this study in order to come up with a highly working and standardized functionality of the system [6].

The outcome of this study was rated by experts in web application development and it received the overall weighted average of “Very Satisfactory” which only means that it satisfies the quality required by the experts [7].

The designed and developed system was deployed and hosted via cloud technology and is now ready for utilization as a solution involving quick responses for any emergencies most especially in an island setting like Bantayan Island [4],[8].

1.1 Objectives of the Study

This study aims to develop Bantayan 911 and evaluate its quality and usability. Specifically, it aims to:

1. Develop a system which;
 - 1.1 Provides user, department, municipal, and super admin portals
 - 1.2 Enables real-time emergency reporting and tracking
 - 1.3 Displays analytics dashboards and reports

1.4 Allows CRUD operations for administrative management

2. Determine the quality of the developed system based on ISO/IEC 25010:2011 Software Quality Model.
3. Determine the usability of the system based on:
 - a. Usefulness
 - b. Satisfaction
 - c. Ease of Use
 - d. Ease of Learning [11]

2. Methods

This study employed a Developmental Research Design utilizing the Agile Software Development Methodology [6].



Figure 1. Agile Software development life cycle

2.1 Agile Development Phases

Phase 1: Compiling Requirements

To determine system requirements, stakeholders such as people, emergency responders, and local government representatives were consulted [9].

Phase 2: Evaluation

Examined were data needs, database structure, security procedures, interface design, and reporting features [10].

Phase 3: Design

The MySQL database, Tailwind CSS, Laravel 10 framework, and online and mobile integration were all part of the system architecture.

Use case diagrams, entity-relationship diagrams (ERD), and data flow diagrams (DFD) were created.

Phase 4: Examination

The USE Questionnaire and the ISO/IEC 25010 Software Quality Model were used to assess the system [11].

Phase 5: Execution

A group of stakeholders and IT specialists were given access to the system to assess it [5].

Phase 6: Evaluation

Feedback was gathered for ongoing development and improvement [12].

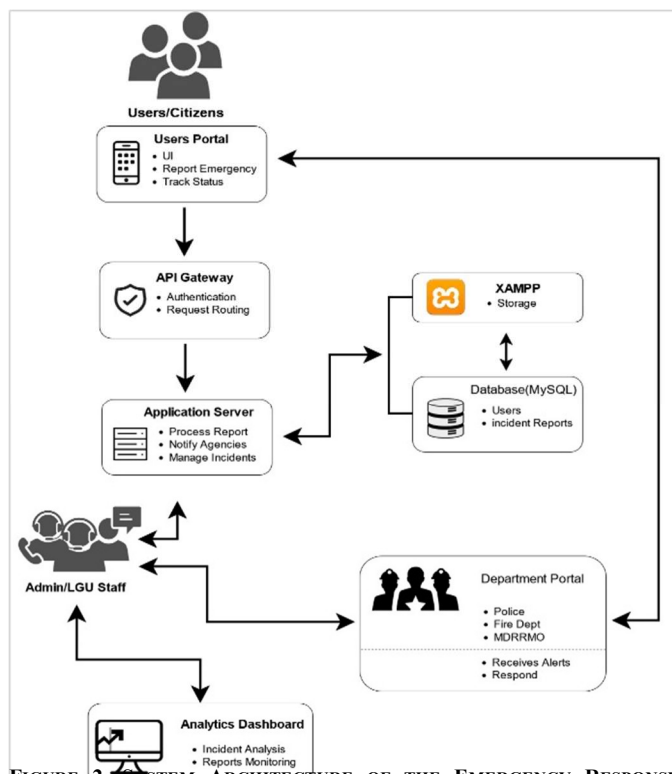


FIGURE 2. SYSTEM ARCHITECTURE OF THE EMERGENCY RESPONSE SYSTEM

2.2 SYSTEM ARCHITECTURE

The multi-layered architecture of the proposed Emergency Reporting and Response System is intended to facilitate effective communication between emergency response units and civilians.

The planned Emergency Reporting and Response System's general architecture is depicted in the picture. The system starts with citizens submitting emergency reports using a mobile or online

application. The Client User Interface (UI), which acts as the front-end layer in charge of gathering user input and displaying data to users, transmits these reports.

The API Gateway, which manages request management, authentication, and communication between the front-end and backend services, receives the requests from the client interface. The request is sent to the Application Server, where the system's primary processing occurs, following authentication and validation. The application server coordinates with the relevant emergency response units, handles notifications, and processes emergency reports.

Large files, such as uploaded photos and documents, are kept in XAMPP to enhance system efficiency and scalability, while all structured data, like user accounts and incident reports, is kept in the MySQL database. Notifications are sent to the appropriate emergency response units, such as the police, fire department, MDRRMO, and system administrators, after the complaint has been reviewed. The reported emergency can then be addressed appropriately by these agencies.

All things considered, the design guarantees effective data flow, safe communication, and prompt coordination between residents and emergency personnel.

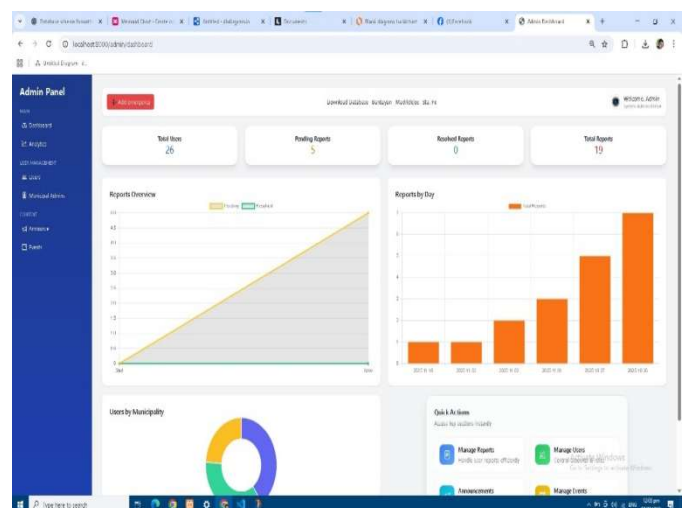


Figure 3. Super Admin

The Super Admin is the highest-level user in the Bantayan 911 system. This role oversees the entire emergency management platform and has full control over system operations, user management, and data monitoring.

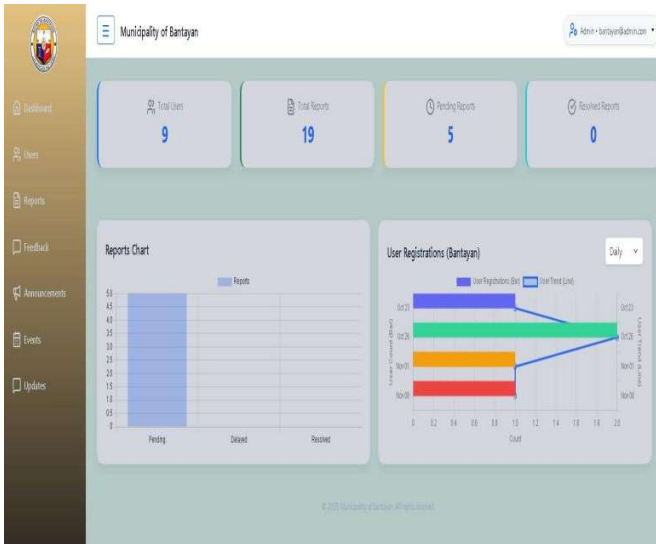


FIGURE 4. MUNICIPALITY DASHBOARD

Municipality Dashboard serves as a central interface for municipal officials and emergency response teams to monitor, manage, and respond to incidents in real time.

awareness across all barangays and municipalities (Bantayan, Madridejos, and Sta. Fe).

3. Results

Table 1. Functional Assessment

System Module	Mean Score	Descriptive Rating
Provides user, department, municipal, and super admin portals	4.76	Highly Functional
Enables real-time emergency reporting and tracking	4.73	Highly Functional
Displays analytics dashboards and reports	4.74	Highly Functional
Allows CRUD operations for administrative management	4.75	Highly Functional
Overall Mean	4.74	Highly Functional

The table 1 shows that all system modules obtained mean scores ranging from 4.72 to 4.76, indicating that the developed system is highly functional. The overall mean score of 4.74 suggests that the respondents evaluated the system as effective, reliable, and capable of performing its intended functions efficiently.

Table 2. ISO 25010 Software Quality Evaluation

ISO/IEC 25010 Quality characteristics	Mean Score	Descriptive Rating
Functional Suitability	4.75	Excellent
Performance Efficiency	4.72	Excellent
Compatibility	4.70	Excellent
Usability	4.76	Excellent
Reliability	4.73	Excellent
Security	4.74	Excellent
Maintainability	4.71	Excellent
Portability	4.79	Excellent
Overall Mean	4.73	Excellent

The table 2 shows that the developed system achieved an overall mean score of 4.73, interpreted as Excellent, based on the ISO/IEC 25010:2011 Software Quality Model. This indicates that the system performs effectively in terms of functionality, usability, reliability, security, and

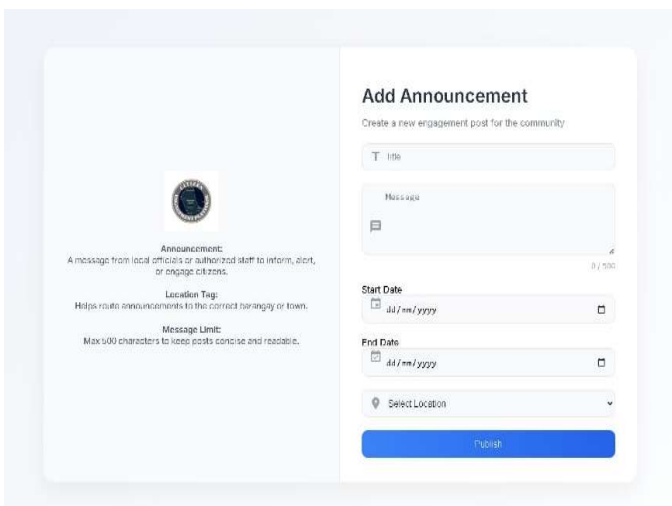


Figure 5. Add announcement

Allow authorized LGU officials, emergency staff, or administrators to publish important updates to citizens within the Bantayan Island 911 platform. Announcements ensure timely communication and

other quality characteristics required for a reliable emergency reporting and response system.

- Integration with national emergency response systems

Table 3. Usability Evaluation

Criteria	Mean	Interpretation
Usefulness	4.75	Agree
Ease of Use	4.63	Agree
Ease of Learning	5.00	Strongly Agree
Satisfaction	4.71	Agree
Overall	4.77	Agree

Table 3 Results indicate high usability and user satisfaction.

4. Discussion

The following section presents a comprehensive discussion, interpretation, and analysis of the research findings.

1. The results show that Bantayan 911 effectively enhances emergency response coordination and supports digital governance in island municipalities.
2. High evaluations in functional suitability and usability reflect the system’s reliability and strong user acceptance. Additionally, the inclusion of dashboard analytics allows administrators to track trends and manage resource allocation more effectively.
3. In comparison with digital civic engagement platforms such as Citizen OS Foundation and IdeaScale, Bantayan 911 provides a more localized governance solution specifically designed for Philippine island municipalities.
4. The application of Agile methodology played a key role in enabling continuous improvement based on stakeholder feedback, leading to a more robust system.

However, several areas require further enhancement, including:

- Improved visual presentation of analytics
- Optimization of offline functionality

5. Conclusion

This study shows that in remote locations like Bantayan Island, the creation of a centralized digital emergency response platform greatly improves the effectiveness and coordination of emergency services [13]. The platform tackles the significant delays that are usually caused by distance and restricted access to qualified staff by combining real-time reporting with a structured response system [5]. The system was methodically created, tested, and improved to satisfy functional and usability requirements thanks to the application of Agile Methodology [6],[7].

Additionally, the system's "Very Satisfactory" rating from web application development specialists attests to its dependability, efficiency, and adherence to quality standards [7]. Its scalability, accessibility, and preparedness for real implementation are highlighted by its cloud-based deployment [8].

Overall, the study finds that the suggested platform is a workable and useful way to enhance public safety, enable digital governance in island communities, and improve emergency response operations [1]. Additionally, it lays the groundwork for future improvements and possible uptake in other isolated or disaster-prone regions.

Acknowledgment

The completion of the research entitled Bantayan 911: A Centralized Emergency Response and Citizen Engagement System for Bantayan Island is the result of the collective dedication, perseverance, and collaborative effort of its researcher-authors: Justin Mark Kaquilala, Ishie Myca B. Jayme, Kerbie Villaceran, and Royce Vincent Landero, and sAlso Mr. Dino L. Ilustrisimo, PhD. ¹

This capstone project reflects not only their technical competence in system design and

development but also their shared commitment to creating a meaningful technological solution that promotes public safety and strengthens emergency response coordination within Bantayan Island.

Each author contributed unique strengths to the success of this study. Through leadership, documentation expertise, system development, analytical thinking, and teamwork, they transformed conceptual ideas into a fully developed and evaluated emergency response platform. Their resilience during revisions, evaluations, and system improvements demonstrates their maturity, professionalism, and determination to meet academic and industry standards.

The development of the Bantayan 911 system stands as proof of their growth as future Information Technology professionals. Their collaboration exemplifies unity, responsibility, and mutual respect—qualities essential in both academic research and real-world system development.

This achievement, completed in partial fulfillment of the requirements for the degree of Bachelor of Science in Information Technology at Madridejos Community College, marks an important milestone in their academic journey and serves as a foundation for future innovation and professional excellence.

May this work remain a testament to their dedication, teamwork, and commitment to serving the community through technology.

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