The Research Probe
Volume 6 Issue 1 June 2026
DOI: https://doi.org/10.53378/trp.221

KALINGA: Katalyst Application with Localized Interactive Guided-Relief Map

[1]Mark Joshua Catarina, [1]Ma. Dannah Amores, [1]Kenn John Patalinjug, [1]Kyla Jade Agua, [2]Marjorie Reso, [3]Windel Pelayo, [4]Jonel Gelig & [5]Leonard Balabat

Abstract

The Philippines experiences natural and man-made disasters, yet preparedness and response to disaster victims is still low due to fragmented communication, misinformation, and the lack of a common platform for coordination. To address these gaps, the researchers developed Kalinga. This mobile disaster-response application would help citizens access relief distribution schedules, emergency hotlines, evacuation center locations, and shelter information, even when offline. The application aims to improve the accessibility, transparency, and organization of disaster-related information and resources. The study used Agile methodology, which facilitated iterative program development and enabled continuous improvement based on user feedback. The app was enhanced and tested with ISO 25010-based User Acceptance Testing with 50 citizens of the various barangays of Bogo City, two (2) LGU representatives of the CSWD, three (3) barangay level respondents, three (3) city level respondents, and one (1) IT expert. The UAT questionnaire included various software characteristics to evaluate Kalinga, rated on a 5-point Likert scale. Findings yielded a cumulative weighted mean of 4.23, indicating that Kalinga is operational, easy to use, dependable, and capable of successfully coordinating communication and coordination in the event of a disaster. However, the study has identified limitations, including network instability, varying levels of users' technological knowledge, and the use of a token-based AI chatbot, which would restrict access for all individuals in actual disaster situations. Despite these limitations, the findings indicate that Kalinga can significantly contribute to more effective, efficient disaster response efforts and better support communities.

Keywords: *disaster response, mobile application, location-based, relief operation, local government unit, information management*

Article History:

Received: *March 12, 2026* ***Revised***: *April 17, 2026*
Accepted: *April 20, 2026* ***Published online***: *June 15, 2026*

Suggested Citation:
Catarina, M.J., Amores, M.D., Patalinjug, K.J., Agua, K.J., Reso, M., Pelayo, W., Gelig, J. & Balabat, L. (2026). KALINGA: Katalyst Application with Localized Interactive Guided-Relief Map. *The Research Probe*, 6(1), 70-94. https://doi.org/10.53378/trp.221

About the authors:
[1]Bachelor of Science in Information Technology, Student-researcher, Cebu Roosevelt Memorial Colleges.
[2]Master in Information Technology. Faculty, Cebu Roosevelt Memorial Colleges. Email: marjorie_reso@crmc.edu.ph
[3]Bachelor of Science in Information Technology. Faculty, Cebu Roosevelt Memorial Colleges. Email: windel_pelayo@crmc.edu.ph
[4]Doctor in Management major in Human Resource Management. College Dean, Cebu Roosevelt Memorial Colleges. Email: jonel_gelig@crmc.edu.ph
[5]Bachelor of Science in Information Technology. Program Chair, Cebu Roosevelt Memorial Colleges. Email: leonard_balabat@crmc.edu.ph

1. Introduction

The Philippines is among the most vulnerable nations globally to disasters, regularly experiencing typhoons, floods, earthquakes, volcanic eruptions, industrial spills, and fire outbreaks. Due to the Philippines' location within the Pacific Ring of Fire and the Pacific typhoon belt, the country is very vulnerable to various natural hazards, including volcanic eruptions, earthquakes, and frequent tropical cyclones (GFDRR, 2015). According to the DOST-PAGASA, the frequency and inevitability of disaster exposure are high, with approximately 20 tropical cyclones affecting the Philippines and 8-9 making landfall each year (DOST-PAGASA, n.d.). People are threatened by the unpredictability and inevitability of these disasters across the whole country (Montefalcon et al., 2021).

Disasters are not purely natural events but are the result of the interaction between hazards and human vulnerabilities, such as inadequate infrastructure, poor planning, and limited access to timely information. This perspective is reinforced by the Sendai Framework for Disaster Risk Reduction (UNDRR, 2015), which emphasizes that disaster impacts can be significantly reduced through preparedness, risk-informed decision-making, and the use of technology. Therefore, while hazards are inevitable, disasters themselves are largely preventable through effective disaster risk reduction strategies.

Disaster preparedness in the Philippines remains low despite heightened awareness. Mateo (2024) reported that a national survey conducted by the Harvard Humanitarian Initiative found that households implement very few of the recommended preparedness measures, with a score of 19.2 out of 50, including go bags, first aid kits, communication plans, and disaster management plans. Post-disaster response is always relevant after a natural or human-caused tragedy, especially in hard-to-reach areas. This is why timely, rapid assistance from rescue agencies will reduce fatalities and ensure high efficiency of rescue efforts. These efforts, however, are often not successful due to the lack of an integrated platform for effective communication and coordination. Without a unified system, rescue operations frequently suffer from duplication of effort, mismanagement of resources, and delays in delivering aid to affected populations (Bhanumathi et al., 2024). As a result, some members of the community are left without assistance (Schwab et al., 2017).

Disaster Risk Reduction (DRR) involves handling large volumes of data daily to support planning, preparedness, and response measures to manage the impact of disasters effectively (Nguyen et al., 2019). Past efforts to improve disaster response have demonstrated that fragmented communication and uncoordinated aid delivery are among the causes of poor disaster response, resulting in delays and wasted resources (Didwagh et al., 2025). Therefore, nowadays, there has been a sudden interest in creating applications that facilitate disaster response before a disaster occurs (Baraldo & Franco, 2024).

Despite numerous disaster apps, they often fail to meet users' actual needs in critical situations. People affected by disasters require apps that are easy to understand, load quickly, are simple to navigate, and have reliable, practical functions. However, studies examining the usability of these apps have been limited to a few instances during disasters. Tan et al. (2020) found that app usability may be diminished, increasing the likelihood of abandonment. There is also a lack of research assessing the effectiveness of the apps in actual emergencies, and the apps' usability further influences users' intent to use them. In addition, Tan et al. (2020) identified common usability concerns when using the apps, including irrelevant content, unreliable functionality, complex interfaces that cause high cognitive load, intrusive advertisements, and excessive battery or data usage that harm the user experience during disasters. Meanwhile, according Orong and Hernandez (2019), in the Philippines, a majority of people, particularly young adults, are unaware of the capabilities of emergency or disaster response apps, but most express their willingness to share this information with others.

In response to the identified gaps, the researchers have developed a mobile application called Kalinga: Katalyst Application with Localized Interactive Guided-Relief Map to help citizens and communities during times of crisis. The application aims to provide timely, localized access to relief distribution schedules, emergency hotlines, evacuation centers, and shelter information. Its features include offline use of emergency hotlines, SMS notifications, and an AI-enabled Gemini-powered chatbot to help users with the most commonly asked questions and provide guidance. This project will eventually seek to enhance equal, open, and well-coordinated disaster response by the use of technology.

Furthermore, *Kalinga* was developed to support people and communities in times of crisis, helping them to access the necessary services, resources, and information promptly. To guarantee a fair, systematic, and efficient distribution of relief commodities and other lifesaving tools in the event of calamities, the application relies on location-based services, offline access, and an AI-driven chatbot. In particular, the objectives of the project were the following:

1. to send location-based relief delivery and schedule messages through SMS to notify users of food assistance and other necessary packages in their neighborhood.
2. to provide fast access to area-based emergency hotlines using pre-dial buttons in the app.
3. to allow users to find evacuation centers or shelters and show the proximity and capacity to make informed choices.
4. to provide offline access to valuable information in the event of a disaster, such as emergency hotlines. It will automatically upgrade itself online.
5. to enhance fair access to scarce resources like food, water, and medicine by minimizing misinformation, maximizing transparency, and increasing coordination when conducting relief efforts.
6. to incorporate an AI-based chatbot, which will be able to answer frequently asked questions, direct the users to the closest shelters, evacuation routes, relief distribution procedures, and help with simple medical issues (e.g., first-aid advice, preventive steps, and safety considerations).

2. Literature Review

2.1. Limitations and Challenges of Existing Disaster Response Systems

Many studies have identified persistent gaps in existing disaster response systems, including outdated features, limited offline accessibility, poor usability, and slow response times. Syukron et al. (2024) found that although many disaster platforms provide alert features, users frequently complain about usability, network instability, and app configuration issues, suggesting the need to improve the most critical application features. Recent studies further supported these findings, emphasizing that mobile disaster applications continue to face usability and reliability challenges, particularly in real-time communication and accessibility (Permana et al., 2025). Navarro de Corcuera et al. (2022) observed that most existing systems fail when internet connectivity is disrupted. This limitation was reinforced by recent studies showing that many disaster systems remain highly dependent on stable internet infrastructure, making them ineffective during emergencies (Jan et al., 2025; Wibowo et al., 2025). Even though most current systems continue to suffer from usability and accessibility issues, these gaps can be overcome through improved disaster response applications. Recent systematic reviews confirmed that mobile-based disaster management systems significantly improve preparedness, response coordination, and information dissemination among communities (Permana et al., 2025).

Urbanelli et al. (2024) proposed the ERMES Chatbot to enhance real-time communication during disasters; however, the system focused more on macro-level communication than on individualized features. AI-powered social media platforms are also increasingly being leveraged to improve disaster communication and public engagement. Bhoi et al. (2025) found that smart crisis response systems can analyze social media content to provide timely alerts, verify information, and optimize emergency response strategies. To address the limitations of internet-dependent systems, several studies proposed disaster response applications capable of functioning offline. Al-Sadi et al. (2022) introduced "iĀwhina," a disaster response mobile application designed to operate both online and offline through ad hoc technology. Since ad hoc networking was not available on all devices, alternative solutions such as Bluemergency by Álvarez et al. (2019) utilized Bluetooth Mesh technology and backward-compatible device-to-device communication, enabling users to stay connected without internet access during disasters. Recent literature also emphasized the importance of hybrid communication technologies that combine offline capabilities with adaptive networking to ensure continuity during emergencies (Permana et al., 2025).

2.2. GPS and Geospatial Technologies for Disaster Preparedness and Response

Poor strategic placement of emergency facilities leads to delayed responses and increased risks to human life. Hence, geospatial technologies and GPS integration have been recognized as essential tools in improving disaster preparedness, situational awareness, and emergency response coordination. According to Gabella et al. (2024), GPS-equipped emergency applications helped minimize response time while Wang et al. (2021) noted that the location and availability of emergency facilities significantly influence response times during disasters. Recent studies further confirmed that geolocation technologies significantly enhance situational awareness and response coordination during emergencies (Mustafa et al., 2025).

Diehr et al. (2025) demonstrated that integrating Artificial Intelligence with Geographic Information Systems (GIS) enables proactive risk mapping, rapid hazard identification, and improved emergency coordination, particularly in climate-vulnerable regions. Similarly, hazard and risk-mapping tools developed by the UP NOAH were found effective in increasing community preparedness, although accessibility and information dissemination challenges remained (Cadiz, 2018). Moreover, E-Ligtas, a disaster reporting application in the Philippines, was shown to support timely and accurate disaster reporting while emphasizing user-friendly design (Rey, 2024).

Several disaster applications specifically utilized GPS technology to improve emergency response efficiency. Nige-Tore, developed by Yamori and Sugiyama (2020), used smartphone GPS capabilities to identify user locations and determine whether users had reached safe zones. Similarly, the Philippine-based iMALERT system developed by Oganiza et al. (2019) used GPS-enabled smartphones to geotag emergency photos and provide situational information about affected areas. Aisyah et al. (2026) further indicated that GPS technology significantly improves the precision of identifying critical areas in disaster management. Supporting this, Mustafa et al. (2025) emphasized the role of geospatial data integration in enhancing disaster risk reduction and emergency response efficiency. These works collectively demonstrated the effectiveness of location-based technologies in disaster scenarios and justified their integration into disaster response applications.

2.3. Artificial Intelligence, Chatbots, and Digital Transformation in Disaster Management

The advancement of AI has significantly improved the capabilities of disaster response systems through intelligent communication, automated information delivery, and decision-support mechanisms. Rushitha (2025) introduced Rescue Connect, a lightweight Python-based system integrating real-time alerts, chatbot support, and resource monitoring. Similarly, Zhao et al. (2025) developed a GPT-4-powered AI system that provided disaster preparedness information while encouraging users to seek, share, and act upon disaster-related information. Their findings showed that interactive, human-like communication improved user trust compared to traditional one-way alerts.

Related studies also explored chatbot integration within widely used communication platforms. Peña-Cáceres et al. (2024) developed a chatbot integrated into social media platforms such as WhatsApp and Manychat to provide continuously updated information during emergencies and support decision-making by keeping authorities informed, which also enhance situational awareness during disasters (Betke et al., 2024). AI-driven communication systems also enhance disaster risk communication and public engagement through personalized and real-time interactions (Jan et al., 2025). Furthermore, integration of IoT, AI, mobile platforms, and multi-source digital data improves situational awareness, coordination among authorities, and evidence-based decision-making during emergencies (Fischer-pre et al., 2024) while social media-driven analytics are vital in disseminating disaster information to affected populations (Gopal et al., 2026).

3. Methodology

The study applied the Agile SDLC methodology, which enabled iterative development, user-driven changes, and continuous improvement. Agile has been selected because it is flexible and capable of producing functional results at the close of every iteration.

3.1. Plan

The researchers conducted several activities to determine which features to integrate into the app and identify potential issues that could arise during development. The planning process focused on aligning the system requirements with the needs of stakeholders involved in disaster response and relief operations. Mixed-methods research design was used to gather in-depth information from individuals relevant to the study. For the qualitative approach, the participants selected for the semi-structured interviews were the head of the Disaster Risk Reduction Management Office (DRRMO) and the head of the City Social Welfare and Development (CSWD) of Bogo City, Cebu, Philippines, as they were considered key stakeholders in disaster preparedness, response, and relief operations. After the interview, during which potential issues were identified, the system project requirements were also defined, and *ClickUp* was used to plan the work process. The project was divided into a set of tasks; each member was assigned their responsibilities, and progress was monitored through specific milestones. Furthermore, the quantitative approach was employed during the User Acceptance Testing (UAT) to collect user feedback through surveys and was conducted in later stages of the study, after the development phase.

Functional requirements. The following are the features of *Kalinga* that outline the application's capabilities for ensuring users' safety and convenience during disasters.

User registration access. Kalinga allows users to create an account and log in to the app to gain full access to all features, including relief goods claiming. Additionally, Kalinga gives users the option to browse as a guest, allowing them to view features such as the interactive map, emergency contacts, and the chatbot.

*Shelters or evacuation centers location access***.** *Kalinga* can provide users with a view of available temporary shelters and evacuation centers based on their current location, using GPS integration. Through the interactive map, users can also see the maximum capacity for the evacuation and shelter sites.

AI-powered chatbot. This uses Gemini to answer frequently asked questions during a disaster, directing users to the nearest available temporary shelters or evacuation shelters, and can assist with fundamental medical concerns, such as offering first-aid steps, safety precautions, and prevention tips.

Distribution scheduling. Kalinga provides users with updated schedules for the distribution of relief goods. Admin can update the schedule in real time, and users are notified of changes via in-app and SMS notifications.

Offline access to emergency hotlines. Kalinga allows users to access important information, such as emergency hotlines. It updates automatically when the connection is restored.

Pin location. Kalinga allows users to pin locations on a map, marking areas of interest, such as available resources or facilities. When creating a pin, users can categorize it by type, selecting options such as Food, Water, Medical, Shelter, Clothing, or Other, and provide specific details. This function helps users easily identify and reference key locations for navigation or coordination. The app also has a filtering option that scans the contents of the pin automatically and deletes it if it contains illegal or sensitive products, such as weapons, prohibited goods, or any other material that contravenes the guidelines.

Voting system. Kalinga enables users to upvote or downvote pinned locations based on their experiences. This functionality enables users to evaluate a place's quality and usefulness quickly and provides valuable community feedback on navigation, decision-making, and enhancements.

Community chat. Kalinga offers its own tab, a safe, moderated environment where users can ask questions, find advice, or express concerns about disaster scenarios; it is like a well-planned freedom wall for community support.

Weather and quake monitor. Kalinga provides a Weather and Quake Monitor, available on the home screen, that delivers real-time updates on local weather and seismic events; a safety panel of quick access that keeps the user aware, informed, and prepared by providing real-time updates and necessary hazard information.

Non-functional requirements. This section outlines the non-functional requirements, establishing its quality features, usability, and operational limits to ensure the system is reliable, secure, usable, and compatible in the event of a disaster.

Performance. *Kalinga* should respond quickly and touch naturally as individuals use the site's essential functions, such as the interactive map or the emergency contact dialer. Even with numerous users, it must remain stable and responsive, without any lag or crashes. It must be able to support a large number of users simultaneously without slowing down. The user must be able to take a couple of seconds to act, such as opening the map or the chatbot. It should be running smoothly and without unnecessary delays.

Security. *Kalinga* uses encrypted passwords to ensure account safety and can be accessed only by authorized personnel in the LGU disaster management office with administrative access. The user data the admin can see includes the user's name, contact number, address, and the user's relief goods claim history. However, confidential data such as passwords will be encrypted. It gives the user the freedom to either log in as a guest or to have others log in using the username and password they created during sign-up.

Usability. *Kalinga* has an intuitive, very user-friendly interface, with clear navigation menus, simple icons, and a minimal layout to avoid clutter. This, in turn, allows tech-savvy and non-tech-savvy people to navigate and use the system easily.

Compatibility. Once deployed, *Kalinga* is compatible with both IOS and Android devices, regardless of their version. It functions with or without an internet connection; however, features such as the chatbot and interactive map are unavailable when network connectivity is unavailable. The primary purpose of having a feature available and accessible offline, such as emergency contact, is to ensure users can still access potentially lifesaving information during a disaster when network connectivity is weak or lost.

However, several limitations were identified that may affect system implementation and performance. The application depends on internet connectivity; certain features of the app such as location pinning, login, and the chatbot become unavailable, which is common during disasters. Moreover, not all users will be able to interact with the AI chatbot because it is token-based, which means that each response made by users consumes limited number of tokens from the system. Once all tokens are consumed, the chatbot may become temporarily unavailable until tokens are replenished, which will limit continuous usage for users. Ultimately, Kalinga was implemented and evaluated within Bogo City, which implies that all forms of crisis experiences and user demand in other locations will not be exhaustively covered by the study.

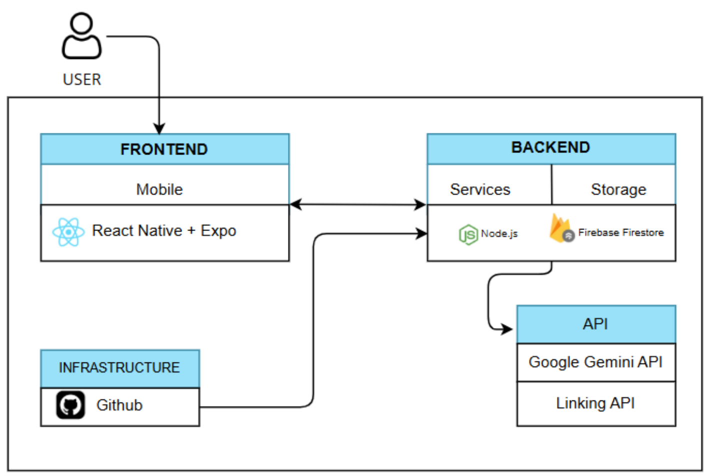
3.2. Design

The researchers developed the user interface repeatedly and thoroughly mapped the system flow of the *Kalinga*. The following diagrams show the overall structure of *Kalinga*. The diagrams also demonstrate the technologies used to develop the system's frontend and backend, and how they interact.

System architecture diagram. As illustrated in Figure 1, the system architecture diagram is a well-designed view of the application, with emphasis on the communication between the primary elements.

Figure 1

System architecture for Kalinga

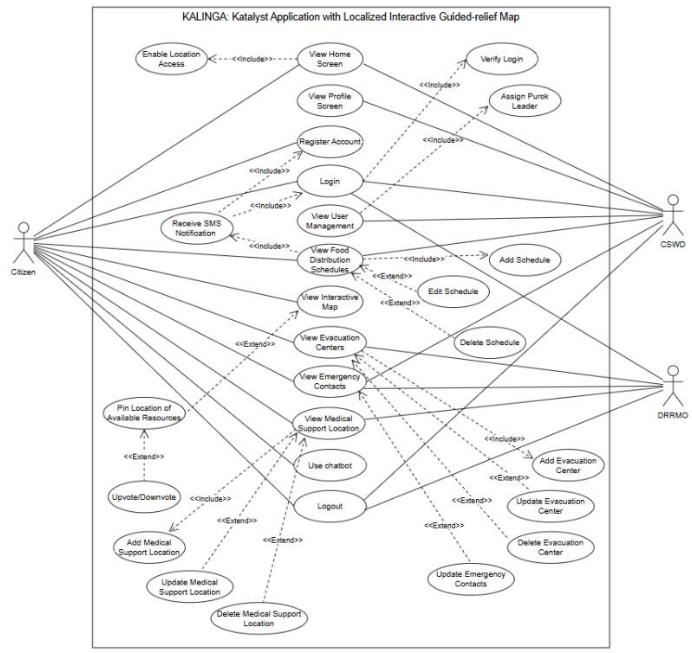


Communication with a mobile frontend built with React Native and Expo enables managing the user interface and communicating with a Node.js server and Firebase Firestore to provide services and store data. It connects to external APIs, such as Google Gemini and the Linking API, to expand functionality, and its code is managed in GitHub. The flowchart clearly outlines the system's component flow and deployment, with a focus on modularity and scalability.

Use case diagram. As illustrated in Figure 2, the use case diagram shows how the citizens, CSWO, and DRRMO interact with the *Kalinga* application, which considers basic functions in disaster response and relief. The most important functions are to view nearby resources, use an interactive map, and distribute relief goods.

Figure 2

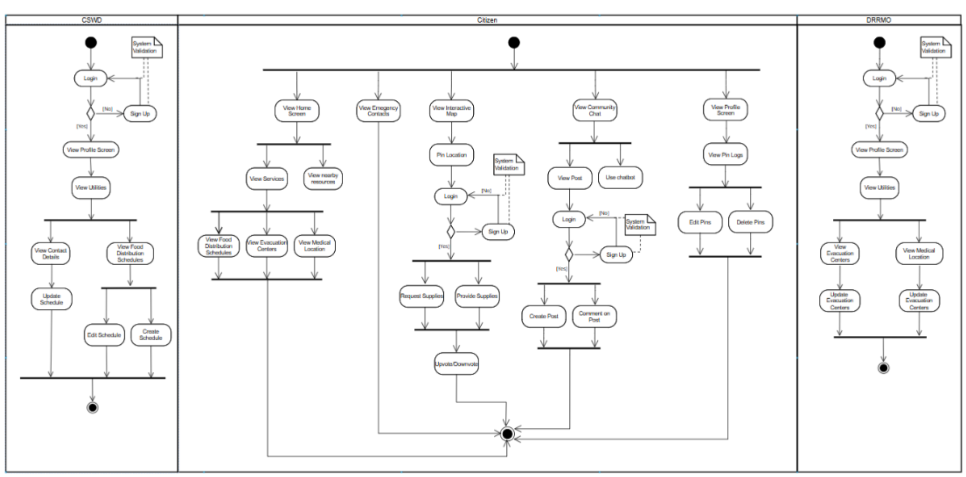
Use case diagram for Kalinga



Activity diagram. As illustrated in Figure 3, the activity diagram depicts a definite flow of user activities in *Kalinga*, beginning with the first entry point and branching into different activities or actions.

Figure 3

Activity diagram for Kalinga



The main features include seeing the interactive map, the schedule of relief goods distribution, and evacuation points. It also includes support applications, such as emergency contacts and a chatbot, that provide a complete picture of the user journey and decision points within the app.

3.3. Develop

Kalinga was built on a technology foundation that uses React Native and Expo to deliver a cross-platform experience across all mobile devices. The backend services were built on a dual-database framework, with Firebase Firestore for storing and synchronizing real-time data, Supabase for storing media, and Serverless Edge Functions for dispatching push notifications. The chatbot engine was deployed on the Google Gemini API, using context-aware data retrieval from Firebase collections to provide thoughtful responses to disaster-related issues. The interactive mapping platform was created with Leaflet, powered by OpenStreetMap via WebView, and the Weather and Quake Monitor was created using real-time data from the OpenWeatherMap API, the USGS Earthquake API, and the EMSC SeismicPortal API. The other integrations were the IProg SMS API, used to send text-based notifications, and the SightEngine API, used for automatic image moderation of user-posted content. Finally, the development team used GitHub for version control. Due to the development process, *Kalinga* was implemented and fully featured to provide real-time disaster information, smart AI-assistance, and community-based reporting.

Description of the prototype. As illustrated in Figure 4, the app prompts users to turn on their location; otherwise, certain app features remain inaccessible, such as weather and earthquake notifications, nearby resources and services, and an interactive map.

Figure 4

User home screen

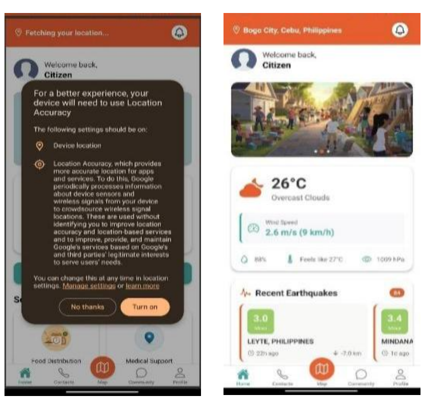


Figure 5

Emergency contacts screen

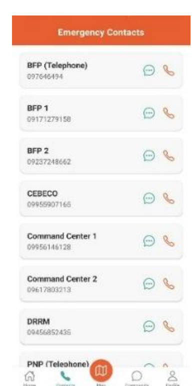


Figure 5 displays emergency pre-dial numbers, with buttons that redirect users to phone calls or messages, thereby ensuring quick access to essential contacts during emergencies.

Figure 6

Interactive map interface

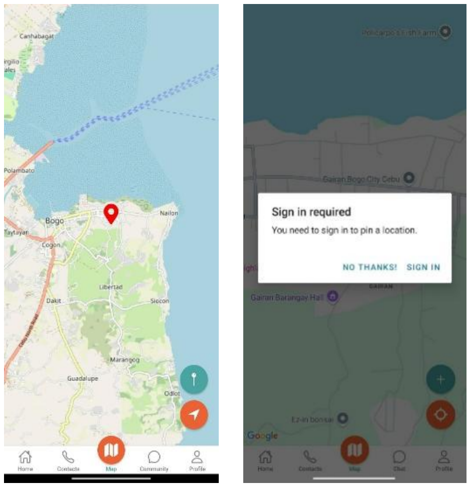
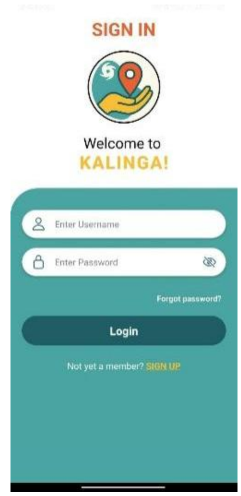


Figure 7

Sign in



As illustrated in Figure 6, the app prompts users to login before they can view pinned locations, ensuring that their interactions and feedback are securely tied to their account.

As illustrated in Figure 7, the app prompts users to enter their credentials (i.e., username and password) to view pinned locations and other essential app features, providing a secure and personalized experience.

Figure 8

Pin location

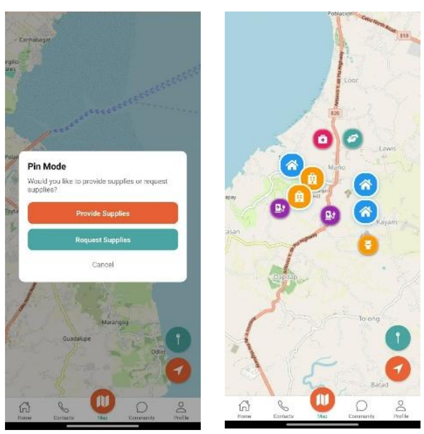
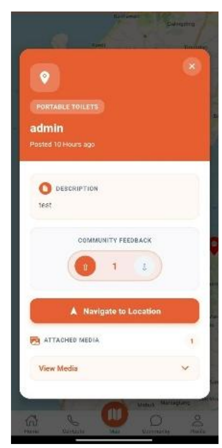


Figure 9

Voting system



As illustrated in Figure 8, the user can pin any available resources (e.g., relief goods, medical assistance, evacuation centers), making it easy to find the necessary services during and after a disaster. When pinning a location, the user can choose to request or provide supplies, allowing the community to easily determine whether a location needs help or can provide assistance. This improves the coordination process and makes resource distribution more efficient.

Figure 9 shows the voting system, allowing users to upvote or downvote posts, comments, or pinned locations. The voting option helps unearth the best and most trustworthy content by allowing community members to evaluate the utility and truth of shared information. This ensures users can find reliable updates that enhance decision-making and general coordination before, during, and after a disaster.

Figure 10

Community chat

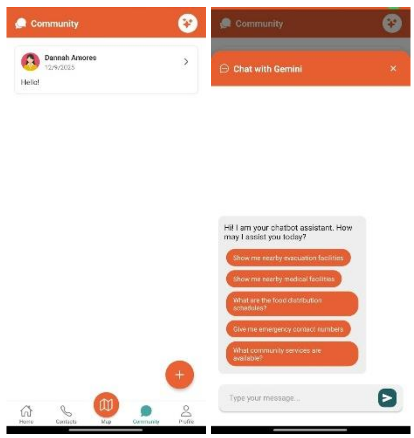


Figure 10 shows the community chat, which includes a community posting section and an integrated Gemini AI chatbot. Users can post to ask questions, provide updates, or discuss community concerns, and other users can respond with comments to make the interaction meaningful. Moreover, the built-in chatbot provides instant help with frequently asked questions, safety measures, the relief distribution process, evacuation routes, and other crucial information, offering users quick, practical guidance in a critical situation.

3.4. Test

The study used the ISO/IEC 25010 framework to administer a User Acceptance Testing (UAT) survey to evaluate the app's functionality, performance, and dependability. Moreover, structured questionnaires were used by asking the participants to complete the forms to collect quantitative data using a 5-point Likert scale, and qualitative data were additionally collected through unstructured, personal interviews with the users. These combined data were then used to inform the analysis of the application from both the citizen and LGU perspectives.

The survey on the citizen side consisted of assessing functional adequacy to ensure that adding an account, reporting an issue, communicating with an AI chatbot, scheduling relief goods, and using interactive maps were functional; interaction ability to assess the usability of the interface design; and security to confirm that the user data is not compromised. The survey on the LGU side evaluated functional appropriateness, performance efficiency, interaction capability, dependability, and security to ensure that the app has met the requirements of disaster management, responded promptly, executed regularly, and secured sensitive information.

The UAT participants included two (2) LGU disaster management officials, three (3) city-level responders, three (3) barangay-level responders, fifty (50) citizens (10 participants per selected barangay), and three (3) IT experts. The researchers evaluated the application against their requirements and relied on their feedback to enhance it.

Table 1

Distribution of participants

Participant Group	Number of Participants	Percentage
LGU Disaster Management Officials	2	3.28%
City-level Responders	3	4.92%
Barangay-level Responders	3	4.92%
Citizens *(with disaster experience)*	50	81.97%
IT Experts	3	4.92%
TOTAL	**61**	**100%**

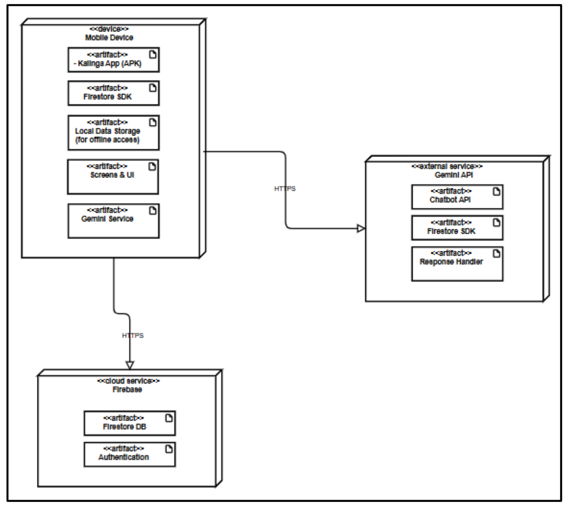
3.4. Release

The system was deployed for citizen use, ensuring a smooth transition from development to live deployment. The researchers provided end-user training before its release to ensure they were well aware of how the *Kalinga* application operated, including its interactive map and other necessary functions.

Deployment diagram. As shown in Figure 11, the deployment diagram assumed a modular architecture of a mobile device, Firebase cloud services, and the Gemini external API. The *Kalinga* App, Firestore SDK, local storage, user interface, and Gemini service were the core components on the mobile device and provided offline experience and responsive interactions. The app was secured via HTTPS, connected to Firebase for authentication and real-time database access, and connected to the Gemini API to use the chatbot and AI-driven replies.

Figure 11

Deployment diagram for Kalinga



3.5. Feedback

Following the successful implementation of the application and user testing, the gathered feedback was analyzed, and potential system improvements were identified. Weighted mean was utilized to determine the overall user satisfaction, and pinpoint which aspect of the app has the most frequent problems. The results were then applied to identify areas for improvement, focused on user-centered changes, and suggested additional features to enhance the system's effectiveness and usability further.

Table 2

User percentage retrieval

Participant Group	Target	Actual Participants	Percentage
LGU Disaster Management Officials	2	2	100%
City-level Responders	3	3	100%
Barangay-level Responders	3	3	100%
Citizens *(with disaster experience)*	50	50	100%
IT Experts	3	1	33.33%
TOTAL	**61**	**59**	**96.72%**

Shown in Table 2 are the user retrieval rates, which reached most targeted user groups, resulting in a total response rate of 96.72%. Full participation was ensured among LGU disaster management officials, city-level responders, barangay-level responders, and citizens with disaster experience, ensuring that the desired feedback incorporates the views of critical stakeholders. The retrieval rate for the IT Expert group was lower at 33.33%, which might limit the extent of technical insights and evaluation contributed by group. In general, a high participation rate indicates the credibility of the collected data and a firm foundation for further analysis of user feedback and system performance.

3.6. Research Ethics

This study followed ethical standards in conducting research involving human participants. Permission was obtained from the Disaster Risk Reduction and Management Office (DRRMO) and the City Social Welfare and Development (CSWD) before data collection. The study was conducted in a controlled, non-disaster environment to ensure the safety of participants and to avoid exposure to actual hazard situations during the app testing. Each participant was provided with a consent form explaining the purpose, procedures, risks, and benefits of the study. Participation was voluntary, and participants were informed of their right to withdraw at any time without penalty and to skip any questions they were not comfortable answering.

To ensure data privacy and confidentiality, participants were identified only by their roles, and all collected data, including audio recordings, were securely stored and used solely for academic purposes. No personally identifiable information was disclosed in the study. Since the app includes a “Relief Map” feature that uses location data, measures were taken to protect sensitive information. Location data were used only for testing and were not stored permanently or linked to specific individuals. This ensured that no personal location information was exposed or misused.

4. Findings and Discussion

This section presents all the results of the UAT, which was implemented to test the functionality, usability, and security of the *KALINGA*. A total of fifty (50) citizens, two (2) disaster management officials from the LGU, three (3) city-level responders, three (3) barangay-level responders, and one (1) IT expert successfully utilized and evaluated the application.

Table 3

ISO/IEC 25010-based evaluation results from citizens

Characteristic	Weighted Mean	Interpretation
Functional Suitability	4.14	Agree
Security	4.08	Agree
Interaction Capability	4.22	Strongly Agree
Overall Weighted Mean	**4.15**	**Agree**

Verbal interpretation scale: Strongly Agree (4.21–5.00), Agree (3.41–4.20), Neutral (2.61–3.40), Disagree (1.81–2.60), Strongly Disagree (1.00–1.80).

Table 3 presents the evaluation results from citizen respondents based on the ISO/IEC 25010 quality model. All evaluated characteristics obtained weighted means above 4.00, with an overall weighted mean of 4.15, interpreted as Agree. This indicates that the app is highly acceptable to Bogo City citizens. Among the characteristics, Interaction Capability received the highest rating (4.22), suggesting that users found the system easy to use and effective for communication, which is important during emergency situations. Functional Suitability (4.14) was also rated highly, indicating that the system's features align with user needs. However, Security (4.08), while still rated strongly, received the lowest score among the three, which may reflect minor concerns regarding data protection or user trust. Overall, the results indicate that the system is user-friendly and functional, while highlighting the need to further strengthen security features to enhance user confidence.

Table 4

ISO/IEC 25010-based evaluation results from disaster responders and officials

Characteristic	Weighted Mean	Interpretation
Functionality Suitability	4.48	Strongly Agree
Performance Efficiency	4.58	Strongly Agree
Interaction Capability	4.68	Strongly Agree
Reliability	4.29	Strongly Agree
Security	4.42	Strongly Agree
Overall Weighted Mean	**4.49**	**Strongly Agree**

Verbal interpretation scale: Strongly Agree (4.21–5.00), Agree (3.41–4.20), Neutral (2.61–3.40), Disagree (1.81–2.60), Strongly Disagree (1.00–1.80).

Shown in Table 4 are the evaluations of the LGU respondents, including two (2) disaster management officials, three (3) city-level responders, and three (3) barangay-level responders, based on the ISO/IEC 25010 quality model, yielding an overall weighted mean of 4.49, interpreted as Strongly Agree. This indicates a high level of system acceptance among LGU respondents. Interaction Capability received the highest rating (4.68), suggesting that the system effectively supports communication and coordination, which are essential during disaster response. Performance Efficiency (4.58) and Security (4.42) also scored highly, indicating that the system performs well under constrained conditions and maintains user trust in handling sensitive data. Meanwhile, Functionality Suitability (4.48) and Reliability (4.29), although still rated strongly, received slightly lower scores, which may indicate areas where system features and stability can still be improved, especially under unpredictable disaster conditions.

These findings suggest that the system is effective in facilitating LGU operations, particularly in communication and coordination, while highlighting the need for further enhancement in feature completeness and system robustness. Additionally, the LGU respondents made several recommendations to improve the app. These include incorporating a resource availability feature to display available resources for better allocation and implementing an eligibility-check system to inform users of their qualification for specific resources. These suggestions aim to improve transparency, usability, and overall system effectiveness.

Table 5

ISO/IEC 25010-based evaluation result of IT expert

Characteristic	Weighted Mean	Interpretation
Functionality Suitability	4.00	Agree
Performance Efficiency	4.60	Strongly Agree
Compatibility	3.33	Neutral
Interaction Capability	4.00	Agree
Reliability	4.00	Agree
Security	4.40	Strongly Agree
Maintainability	4.00	Agree
Overall Weighted Mean	**4.05**	**Agree**

Verbal interpretation scale: Strongly Agree (4.21–5.00), Agree (3.41–4.20), Neutral (2.61–3.40), Disagree (1.81–2.60), Strongly Disagree (1.00–1.80).

Shown in Table 5 are the results of the evaluation of the IT expert according to the ISO/IEC 25010 quality model. The system received an average weighted score of 4.05, rated Agree, indicating that it meets an acceptable technical standard. Performance Efficiency and Security were rated as Strongly Agree, suggesting that the system is well-optimized and implements appropriate measures for protecting data, which are critical in handling sensitive information during disaster response. However, Compatibility received the lowest rating, which may indicate limitations in the system's ability to function consistently across different devices or platforms, especially in environments with varying technical conditions. These findings suggest that while the system performs efficiently and securely, improvements are needed to ensure broader accessibility and seamless operation across devices.

Some features that the IT expert suggested to improve included the addition of real-time notifications, enhanced compatibility across devices through appropriate development tools, improved navigation by reducing pop-up modals, and strengthened data reliability through caching mechanisms. The expert also recommended implementing secure sign-in features such as Google and Facebook authentication, as well as version control using GitHub to maintain code integrity and support continuous system improvement.

5. Conclusion

The *Kalinga*, a mobile disaster response and assistance platform, can effectively fill the gaps in communication, information access, and resource coordination during emergencies in the Philippines by providing location-based notifications, relief distribution times, evacuation center locations, and an AI-assisted chatbot. The User Acceptance Testing (UAT) findings indicated that citizens, the LGU, and an IT expert are satisfied with the app's functionality, ease of use, and reliability. During testing, users said the following functions were convenient in disasters: the interactive map and the relief goods distribution schedule. However, the current limitation is that the system's effectiveness is influenced by network instability and users' levels of familiarity with technology, which may affect accessibility and overall performance during disasters.

Based on the user acceptance testing, respondents made several recommendations to improve *KALINGA*. First, the app should include a function that monitors resource availability, displaying the number of resources claimed by people, and automatically marking the post as completed once all resources are taken, similar to indicating whether a lobby has reached its maximum capacity. Second, clear posting guidelines should be implemented to ensure that resources are genuinely requested or shared with those in need and that users understand proper use. Third, the app should provide local language options, such as Bisaya, and integrate eligibility filters that let users know whether they are eligible to receive resources and identify the nearest location where they can claim them. Fourth, it must appropriately recognize private donors, including the Local Government Unit (LGU), to ensure transparency and inform donors of the intended use of their funds. Fifth, monitoring and updates can be performed regularly to improve app performance, enhance usability, and secure the environment for every user. Besides the recommendations that were made by the Local Government Units (LGUs), more recommendations were made by an expert in IT.

It is recommended to use a schedule or live application notifications to notify users the moment a disaster occurs, e.g., a typhoon or an earthquake. Given that the app is built on React Native, it is possible to enhance stability and performance by confirming that the compilers are suitable. Regarding user experience, it is recommended to minimize pop-up modals and use clickable icons instead of information boxes to ease navigation. To make it more dependable, the app should include appropriate caching and in-store data backups that automatically synchronize when it is connected to the internet. To authenticate a user, even though password complexity rules should be enforced, secure sign-in via Google or Facebook can be more convenient than compromising privacy. Finally, GitHub version control is recommended to manage updates and preserve the integrity of the app's codebase.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This work was not supported by any funding.

Institutional Review Board Statement

This study was conducted in accordance with the ethical guidelines set by Cebu Roosevelt Memorial Colleges. The ethical review and approval were waived for this study.

AI Declaration

The author declares the use of Artificial Intelligence (AI) in writing this paper. In particular, the author used ChatGPT, Microsoft Copilot, and QuillBot in summarizing key points, paraphrasing ideas, searching for relevant literature, and improving the clarity and structure of sentences. The author takes full responsibility in ensuring proper review and editing of content generated using AI.

ORCID

Marjorie Reso – https://orcid.org/0009-0006-4165-5208

References

Al-Sadi, A., Moses, T., & Altawabeyeh, S. (2022). iĀWHINA: Towards Designing an Offline Disaster Mobile Application. *Information Systems for Emergency Management Proceedings*. SCRAM Asia Pacific Conference. https://www.researchgate.net/publication/371159412_iAWHINA_Towards_Designing_an_Offline_Disaster_Mobile_Application

Aisyah, D. N., Rahman, F. M., Diva, H., Putra, B. S., Rizki, M. H., Bisri, M. B. F., & Manikam, L. (2026). Mobile-Enabled Technologies in Disaster Management: A Systematic Literature Review. *Disaster Medicine and Public Health Preparedness*, *20*, e15. http://doi.org/10.1017/dmp.2025.10252

Álvarez, F., Almon, L., Radtki, H., & Hollick, M. (2019). Bluemergency: Mediating Post-disaster Communication Systems using the Internet of Things and Bluetooth Mesh. *2019 IEEE Global Humanitarian Technology Conference (GHTC)*, 1–8. https://doi.org/10.1109/GHTC46095.2019.9033063

Baraldo, M., & Franco, P. D. G. D. (2024). Place-centred emerging technologies for disaster management: A scoping review. *International Journal of Disaster Risk Reduction*, *112*, 104782. https://doi.org/10.1016/j.ijdrr.2024.104782

Betke, H., Peitzsch, S., Boldt, J., Reimann, D., & Kox, T. (2024). Chatbot Based Public Sensoring to improve Situational Awareness. *Proceedings of the International ISCRAM Conference*. https://doi.org/10.59297/h3r7bp59

Bhanumathi, S., Sai, P. H., Rakesh, N., Tribhuvan, K. S., & Uday Kiran, H. S. (2024). Rescue relief agency management for disaster recovery. *International Journal of Advanced Research in Science, Communication and Technology*, *4*, 365–371. https://doi.org/10.48175/IJARSCT-18061

Bhoi, A., Bhuyan, H. B. G. S., Nayak, R. P., & Balabantaray, R. C. (2025). *Smart crisis response leveraging social media content for effective disaster management*. 1–25. https://doi.org/10.1007/s10791-025-09749-1

Cadiz, N. R. (2018). UP NOAH in Building Resilient Philippines; Multi-hazard and Risk Mapping for the Future. *Procedia Engineering*, *212*, 1018–1025. https://doi.org/10.1016/j.proeng.2018.01.131

Didwagh, K., Gadekar, T., & Gupta, Y. (2025). Disaster Response and Relief Co-ordination. *International Scientific Journal of Engineering and Management (ISJEM)*, *4*(4). https://doi.org/10.55041/ISJEM02860

Diehr, J., Ogunyiola, A., & Dada, O. (2025). Artificial intelligence and machine learning-powered GIS for proactive disaster resilience in a changing climate. *Annals of GIS*, *31*(2), 287–300. https://doi.org/10.1080/19475683.2025.2473596

Fischer-pre, D., Bonaretti, D., & Bunker, D. (2024). Digital transformation in disaster management : A literature review. *Journal of Strategic Information Systems. 33*(September), 1–25. https://doi.org/10.1016/j.jsis.2024.101865

Gabella, J. L., Gualda, I. A. P., Altoé, I. L., Beltrame, M. H. A., da Silva, P. H. A., Costa, D. B., Paggi, F. C. G., Filho, S. S. F., Massago, M., de Paulo, L. G., Bitencourt, M. R., Joiner, A. P., Nickenig Vissoci, J. R., & de Andrade, L. (2024). Designing, development and validation of an app to reduce the response time of the emergency medical services. *PLoS ONE*, *19*(3), 1–15. https://doi.org/10.1371/journal.pone.0299828

Global Facility for Disaster Reduction and Recovery. (2015). *Philippines: Typhoon Yolanda ongoing recovery*. The World Bank Group. https://www.gfdrr.org/sites/default/files/publication/rfcs-2015-philippines.pdf

Gopal, L. S., Prabha, R., Thirugnanam, H., & Ramesh, M. V. (2026). Review article : Social media for managing disasters triggered by natural hazards : a critical review of data collection strategies and actionable insights. *Natural Hazards and Earth System Sciences*. *26*, 215–250. https://doi.org/10.5194/nhess-26-215-2026

International Organization for Standardization. (2011). *ISO/IEC 25010: Systems and software engineering—Systems and software quality requirements and evaluation (SQuaRE)—System and software quality models*. https://www.iso.org/standard/35733.html

Jan, M. A., Ullah, S., Ali, A., Tariq, H., Fernando, T., & Saeed, M. (2025). *Testing and evaluation of Pakistan ' s pioneer disaster risk communication app : a case study of PDMA Madadgar android-based app*. https://doi.org/10.3389/fcomm.2025.1572206

Mateo, J. (2024). Despite improvement, disaster preparedness among Filipinos still lacking – study. *The Philippine Star*.

https://www.philstar.com/headlines/2024/11/09/2398726/despite-improvement-disaster-preparedness-among-filipinos-still-lacking-study

Montefalcon, M. D., Padilla, J. R., Ibanez, M., Sapinit, R., Reyes, L. L., Llabanes Rodriguez, R., & Serrano, E. (2021). IRespondPH: A Mobile and Web-based Application for Post Disaster Needs Assessment and Response in the Philippines. *2021 5th International Conference on E-Society, E-Education and E-Technology, ICSET 2021*, 54–61. https://doi.org/10.1145/3485768.3485784

Mustafa, R., Han, J., & Sarkar, N. I. (2025). *Secure Cross-Layer Mobile Sensing Framework for Real-Time Disaster Reporting and Visualisation Using a Mobile Application*. 1–32. https://doi.org/10.3390/s25216766

Navarro de Corcuera, L., Barbero-Barrera, M. del M., Campos Hidalgo, A., & Recio Martínez, J. (2022). Assessment of the adequacy of mobile applications for disaster reduction. *Environment, Development and Sustainability*, *24*(5), 6197–6223. https://doi.org/10.1007/s10668-021-01697-2

Nguyen, Q. N., Frisiello, A., & Rossi, C. (2019). The Design of a Mobile Application for Crowdsourcing in Disaster Risk Reduction. *International Conference on Information Systems for Crisis Response and Management*. https://api.semanticscholar.org/CorpusID:211724379

Oganiza, O. P., Reselva, M. P., Vicencio, J. P. V., Casim, R. C., & Subia, G. S. (2019). iMALERT – an Emergency Response Mobile Application Using Geo-Location for Palayan City Disaster Risk Reduction and Management Office. *International Journal of Advanced Engineering, Management and Science*, *5*(7), 446–453. https://doi.org/10.22161/ijaems.573

Orong, M. Y., & Hernandez, A. A. (2019). User acceptance of emergency and disaster response mobile application in the Philippines: An investigation based on the unified theory of acceptance and use of technology model. *International Journal of Enterprise Information Systems*, *15*(1), 85–99. https://doi.org/10.4018/IJEIS.2019010105

Peña-Cáceres, O., Tavara-Ramos, A., Correa-Calle, T., & More-More, M. (2024). Integral Chatbot Solution for Efficient Incident Management and Emergency or Disaster Response: Optimizing Communication and Coordination. *TEM Journal*, *13*(1), 50–61. https://doi.org/10.18421/TEM131-05

Permana, I., Dewi, R., & Budhiana, J. (2025). Mobile Applications and Community Disaster Preparedness : Insights from a Scoping Review. *The Malaysian Journal of Nursing*, *16*(April), 147–157. https://doi.org/10.31674/mjn.2025.v16isupp2.017

Rey, W. P. (2024). E-Ligtas in Focus: A PACMAD-Based Usability Evaluation of Emergency Reporting in the Philippines. *Proceedings of the 2024 The 6th World Symposium on Software Engineering (WSSE), 24*, 121–128. https://doi.org/10.1145/3698062.3698078

Rushitha, M. (2025). Rescue Connect: AI-Powered Disaster Relief System. *International Journal for Research in Applied Science and Engineering Technology*, *13*(4), 3828–3834. https://doi.org/10.22214/ijraset.2025.68472

Schwab, A. J. M., Omaña, J. E. C., Roazol, K. V., Abe, T. A. Y., & Fabito, B. S. (2017). iSagip: A Crowdsource Disaster Relief and Monitoring Application framework. *2017 International Conference on Soft Computing, Intelligent System and Information Technology (ICSIIT)*, 327–330. https://doi.org/10.1109/ICSIIT.2017.33

Syukron, M., Madugalla, A., Shahin, M., & Grundy, J. C. (2024). *Design Challenges and User Needs in Disaster Support Mobile Apps: A Large-Scale Analysis of Features and Reviews*. https://api.semanticscholar.org/CorpusID:271098083

Tan, M. L., Prasanna, R., Stock, K., Doyle, E. E. H., Leonard, G., & Johnston, D. (2020). Modified Usability Framework for Disaster Apps: A Qualitative Thematic Analysis of User Reviews. *International Journal of Disaster Risk Science*, *11*(5), 615–629. https://doi.org/10.1007/s13753-020-00282-x

DOST-PAGASA (n.d.). *Tropical Cyclone Information.* https://bagong.pagasa.dost.gov.ph/climate/tropical-cyclone-information

United Nations Office for Disaster Risk Reduction (2015). *Sendai Framework for Disaster Risk Reduction 2015 - 2030*. https://www.undrr.org/publication/sendai-framework-disaster-risk-reduction-2015-2030

Urbanelli, A., Frisiello, A., Bruno, L., & Rossi, C. (2024). The ERMES chatbot: A conversational communication tool for improved emergency management and disaster risk reduction. *International Journal of Disaster Risk Reduction*, *112*, 104792. https://doi.org/10.1016/j.ijdrr.2024.104792

Wang, W., Wu, S., Wang, S., Zhen, L., & Qu, X. (2021). Emergency facility location problems in logistics: Status and perspectives. *Transportation Research Part E: Logistics and Transportation Review*, *154*. https://doi.org/10.1016/j.tre.2021.102465

Wibowo, A., Amri, I., Surahmat, A., & Rusdah, R. (2025). Leveraging artificial intelligence in disaster management : A comprehensive bibliometric review. *Journal of Disaster Risk Studies*, *17*, 1–9. https://doi.org/ 10.4102/jamba.v17i1.1776

Yamori, K., & Sugiyama, T. (2020). Development and Social Implementation of Smartphone App Nige-Tore for Improving Tsunami Evacuation Drills: Synergistic Effects Between Commitment and Contingency. *International Journal of Disaster Risk Science*, *11*(6), 751–761. https://doi.org/10.1007/s13753-020-00319-1

Zhao, X., Sun, Y., Liu, W., & Wong, C. W. (2025). Tailoring generative AI chatbots for multiethnic communities in disaster preparedness communication: extending the CASA paradigm. *Journal of Computer-Mediated Communication*, *30*(1), 1–13. https://doi.org/10.1093/jcmc/zmae022