

Development of Disaster Management Information System Application with Five Integrated Features

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ABSTRACT

Indonesia, as one of the world's largest archipelagic countries, is highly prone to natural disasters due to its geological, geographical, and socio-demographic conditions. Despite various efforts from the government and related institutions, there remains a lack of an integrated technological solution that addresses the critical aspects of disaster management. This research aims to develop a mobile-based disaster management information system called *Aksi Bencana Indonesia*, featuring five integrated functions: real-time disaster information, donation facilitation, volunteer management, logistics coordination, and disaster education. The development process involved identifying functional and non-functional requirements through interviews with disaster mitigation experts and literature studies, followed by UI/UX design using Figma, and coding using Flutter for the frontend and Laravel for the backend. User Acceptance Testing (UAT) was conducted with participants aged 18–55 to evaluate the system's usability and effectiveness. The results showed that the application met the users' expectations in providing timely and reliable information, facilitating donations and volunteer coordination, and supporting educational initiatives. Moreover, the integration of real-time features improved response time and enhanced the efficiency of resource distribution during disaster events. This study concludes that the application successfully bridges the gap between communities, donors, and volunteers, offering a practical solution for disaster preparedness and response. Future research may focus on expanding the system's interoperability with national disaster databases and enhancing the analytics dashboard for better decision-making.

Keywords: Disaster Management; Mobile Application; Volunteer Coordination; Real-Time Information; Integrated System.

INTRODUCTION

The largest archipelagic country in the world, one of which is Indonesia, is a country that is prone to natural disasters, both geologically, geographically, and socio-demographically (Fajar et al. 2024). According to Law Number 24 of 2007, a disaster is a series of events that threaten and disrupt the lives and livelihoods of the community, caused by natural factors or non-natural factors or human factors, resulting in human casualties, environmental damage, property losses and psychological impacts (Yuliano, Kartika, and Alfandi 2019). Indonesia is located at the confluence of three major tectonic plates, namely the Indo-Australian Plate, Eurasian Plate, and Pacific Plate, which causes high potential for earthquakes and tsunamis (Dewantoro 2021). In addition, tropical climate factors with high rainfall also increase the risk of hydrometeorological disasters such as floods and landslides (Sumatirta et al. 2023). This high risk of disaster demands a better mitigation system, especially in the aspects of disaster preparedness and rapid response.

In the 2015-2019 National Disaster Management Plan (RENAS PB) there are several policies that the government wants to achieve, including the implementation of an effective disaster emergency management system and the implementation of efficiency in rehabilitation and reconstruction efforts (Sutedi 2020). This is in line with Article 27 of Law Number 24 of 2007, which emphasizes the importance of community involvement, the private sector, non-governmental organizations, and international organizations in disaster management through targeted, coordinated volunteer activities, and regulated by guidelines covering the roles, rights, and obligations of volunteers at various stages of disaster management, starting from the non-disaster period to the emergency stage and post-disaster rehabilitation-reconstruction (Defanera and Annisa 2021).

At the National Coordination Meeting for Disaster Management on February 22, 2022, the President gave direction that the government must build a sustainable disaster education system where the main focus is prevention in facing disaster risks (Zakiyamani and Manik 2023). Along with the development of the digital era, technological literacy has become an inseparable part of disaster literacy (Eraku, Melo, and Aris 2024). The dissemination of disaster mitigation information currently relies heavily on information and communication technology (ICT) (Galuh et al.

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2024).

In this context, the development of an ICT system that can monitor and reduce the impact of disasters is very important (Kaur, Kaur, and Sood 2022). A good early warning system will help the community be better prepared for disasters, thereby reducing casualties and material losses (Pramono et al. 2024). This is in line with the findings (Aziz 2024) entitled Digital-Based Disaster Communication which shows that digitalization of disasters in the development of ICT systems not only increases public knowledge about disasters, but also forms a new mindset that encourages preventive and responsive actions in dealing with disaster situations, thereby strengthening disaster preparedness and mitigation holistically. In order to answer these needs, this study focuses on "Design and Construction of Disaster Management Mobile Applications". This application is designed to integrate several disaster mitigation functions, such as disaster education, information dissemination, volunteer management, and fundraising effectively, and is expected to contribute significantly to increasing community preparedness in facing disasters and reducing the impacts caused, both in terms of loss of life and material losses.

In developing disaster mitigation-based applications, the methodological approach used must be able to accommodate user needs and system effectiveness in emergency situations. Some previous studies have shown that the use of mobile-based technology can improve disaster preparedness and response (Fahrimal, Reza, and Tjoetra 2019). According to research (Anjani, Kartikasari, and Oktavia 2023), the integration of cloud-based technology and IoT in disaster mitigation can increase the effectiveness of information dissemination and management of aid logistics. In addition, functional and non-functional utilization in the design of disaster mitigation application systems can assist in data management and more accurate decision making (Abraham et al. 2021). In another study, the use of Flutter and Laravel as the main technology in developing disaster mitigation-based applications was shown to provide optimal performance in the integration of important features such as push notifications, location tracking, and volunteer management systems (Fauzi, Teddyana, and Enda 2021). This research also considers aspects of sustainability and accessibility in the development of disaster mitigation applications. According to a study conducted by (Aunurofiq 2018), the sustainability factor in disaster technology implementation involves active community participation and support from various stakeholders. In addition, research from (Fauzi et al. 2021) confirms that mobile-based applications with user-friendly interfaces can increase the effectiveness of information delivery and community preparedness in facing disasters.

Previous studies have highlighted the importance of using Information and Communication Technology (ICT) to improve disaster literacy, real-time information dissemination, and community involvement in emergency response. However, many existing applications tend to focus on isolated features, such as early warning systems or information updates, without providing holistic solutions that include donation management, volunteer coordination, logistics, and educational components in a single platform. This research aims to address these limitations by developing a mobile-based disaster management application, Aksi Bencana Indonesia, which integrates five core features to support disaster preparedness and response. The study investigates the development process, functionality, and usability of the application while exploring how the integration of these features can improve community engagement, accelerate aid distribution, and support better decision-making during disaster events.

LITERATURE REVIEW

The rapid advancement of information and communication technology (ICT) has significantly influenced disaster management strategies worldwide. Several previous studies have emphasized the importance of using digital systems to enhance disaster preparedness, real-time response, and public awareness. For example, (Aziz 2024) explored how digital communication in disaster contexts plays a crucial role in shaping public behavior and promoting proactive responses. Similarly, (Eraku et al. 2024) highlighted the value of disaster literacy education through mobile applications to increase students' responsiveness and awareness in vulnerable regions.

While existing research has proposed various digital tools for specific disaster management functions—such as early warning systems, emergency mapping, or donation portals—there is a lack of comprehensive platforms that integrate multiple critical components. (Sutedi 2020), for instance, designed an application that identifies disaster-prone areas and safe zones using social media-based reporting. However, the system lacked features for volunteer coordination, logistics, and public education. Likewise, (Zakiyamani and Manik 2023) evaluated the usability of disaster applications in Indonesia, revealing that although many apps exist, most fall short in user engagement and functional completeness.

Furthermore, studies like those by (Defanera and Annisa 2021) and (Fajar et al. 2024) focus on the roles and challenges faced by disaster volunteers, particularly emphasizing the need for better coordination tools and structured information flow. These findings suggest that technology can not only improve response times but also optimize the

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allocation of human and material resources during emergencies.

Despite these contributions, there remains a notable research gap in the development of an integrated disaster management system that combines real-time information, donation management, volunteer coordination, logistic distribution, and educational content into a single, user-friendly mobile application. This gap forms the foundation of the present study, which aims to design and evaluate *Aksi Bencana Indonesia*, a mobile application that addresses these challenges by unifying all five features within one platform. The integration of these components is expected to enhance collaboration among communities, government agencies, and humanitarian organizations, ultimately improving disaster mitigation and response efforts across Indonesia.

METHOD

To overcome the limitations of existing disaster management applications, especially the lack of integration between various important functions, this study proposes the development of a mobile-based application called Aksi Bencana Indonesia. This application is designed to integrate five main features: real-time disaster information, donation management, volunteer coordination, logistics distribution, and educational content on disaster preparedness. This solution is implemented through a structured software development process that combines requirements analysis, design, implementation, and testing. A *Use Case Diagram* was created to describe the interaction between the system and three primary actors: users, administrators, and couriers. It illustrates how these actors engage with core features such as registration, disaster reporting, donation, logistics, and educational access.

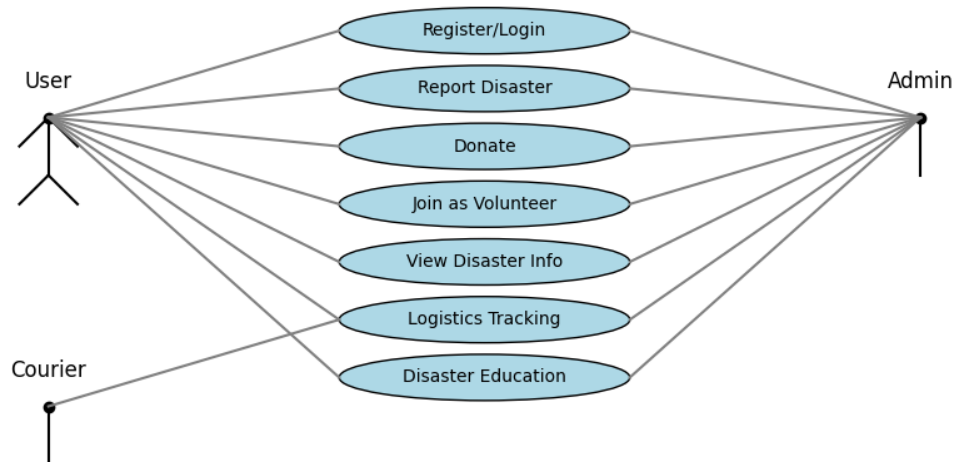


Figure 1. Use Case Diagram of Aksi Bencana Indonesia

As shown in Figure 1, each actor interacts with specific functionalities in the system. For instance, users can report disasters, donate, and register as volunteers; admins handle validation and system management; and couriers manage the logistics tracking and delivery. This diagram provides a high-level overview of system functionality and actor responsibilities, forming the foundation for detailed activity flows.

System Development Methodology

The development follows an iterative and user-centered design approach, incorporating feedback from field experts and potential users to ensure the application meets actual community needs. The key stages include:

1. Requirement Gathering

Data were collected through interviews with disaster management experts, including academics and practitioners, and a review of previous studies. These insights were used to determine the functional and non-functional requirements of the system. To ensure that the *Aksi Bencana Indonesia* application effectively meets user needs, a comprehensive analysis of the functional requirements was conducted. Functional requirements describe the specific behaviors and functions the system must perform to support disaster management activities. These include features related to user interaction, data handling, volunteer management, donation processing, logistics coordination, and communication of disaster-related information. The requirements were identified through interviews with experts, literature reviews, and direct observation of user expectations in disaster-prone communities. The following Table 1. outlines the functional requirements of the system, detailing each function's purpose and the expected user interaction with the application:

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Table 1. Functional Requirements of the Aksi Bencana Indonesia Application

Code	Needs	Description of Requirement
F-01	Volunteer Registration	The system allows users to register as volunteers by filling in a registration form.
F-02	Login & Authentication	The system allows users to log in using email and password or other authentication methods.
F-03	View Disaster Information	The system allows users to view a list and details of current disasters.
F-04	Reporting Disasters	The system allows users to report disaster events by filling out a form and uploading photo/video evidence.
F-05	Donate	The system allows users to donate in the form of money.
F-06	Become a Volunteer	The system allows users to register as volunteers in disaster response actions.
F-07	Managing Logistics	The system allows users to send logistics items by filling out the form.
F-08	Notifications & Updates	The system notifies users with the latest information on disasters and actions to follow.

In addition to functional features, it is crucial to define non-functional requirements to ensure that the system performs reliably under various conditions. Non-functional requirements specify the criteria that judge the operation of a system rather than specific behaviors. These include aspects such as system availability, interface design, device compatibility, and data access security. These elements are essential for ensuring that the *Aksi Bencana Indonesia* application delivers a consistent user experience, maintains data integrity, and operates seamlessly across different platforms and environments. Table 2. below presents the identified non-functional requirements that guide the development and performance standards of the application:

Table 2. Non-Functional Requirements of the Aksi Bencana Indonesia Application

Code	Needs	Description of Requirement
NF-01	System Availability	The system is accessible 24 hours x 7 days and can be accessed from anywhere as long as it is connected to the internet.
NF-02	Interface Design	The app displays pages with a simple, intuitive, and easy design used.
NF-03	Device Compatibility	The system can be accessed through Android-based devices.
NF-04	Access Security	Only the account owner has access rights to login and manage data personal.

2. System Design

User Interface (UI) and User Experience (UX) designs were created using Figma, focusing on accessibility, simplicity, and responsiveness for Android users. A *Use Case Diagram* was created to describe the interaction between the system and three primary actors: users, administrators, and couriers. In addition, *Activity Diagrams* were developed to model the process flow of each core feature, such as donation, volunteer registration, and logistics handling.

3. System Implementation

The application was developed using Flutter for the frontend and Laravel for the backend. This combination ensures a responsive user interface and robust data processing capabilities. Each module was implemented as a separate feature that communicates through a secure API, allowing scalability and modular maintenance.

4. Testing and Validation

The application underwent User Acceptance Testing (UAT) with respondents aged 18–55 who live in disaster-prone areas. The test scenarios included tasks such as viewing disaster data, registering as volunteers, submitting donations, and accessing educational content. Feedback was analyzed to assess usability, performance, and accuracy in meeting user expectations.

Functional Architecture

The functional architecture of the application consists of five primary modules:

1. Real-time Disaster Monitoring Module: Synchronizes with the official BNPB database to provide up-to-date information on disaster events across Indonesia.
2. Donation Management Module: Allows users to donate funds and goods, choose payment methods, and track donation status.
3. Volunteer Coordination Module: Manages volunteer registration, approval by admins, task assignments, and reporting mechanisms.
4. Logistics Management Module: Handles the collection, categorization, delivery, and tracking of aid items with courier interaction.
5. Disaster Education Module: Provides accessible information and learning materials about disaster types and preparedness strategies.

System Diagram Overview (Verbal Description)

In the Use Case Diagram, three primary actors, User, Admin, and Courier, interact with the system:

1. Users can register/login, report disasters, donate, join as volunteers, and access educational content.
2. Admins manage disaster reports, volunteer applications, donations, and educational materials.
3. Couriers receive logistic assignments and update delivery statuses in real-time.

RESULT

The findings from the research show that the "Aksi Bencana Indonesia" application successfully enhances community preparedness and disaster response capabilities. Through User Acceptance Testing (UAT), involving respondents aged 18 to 55 living in disaster-prone areas, the application received overwhelmingly positive feedback. Users acknowledged that the application provides a convenient and effective platform for accessing real-time disaster data, submitting disaster reports, making donations, volunteering, accessing educational materials, and managing logistics during emergency situations.

One of the most appreciated features was the real-time disaster monitoring, which synchronizes data from credible national sources such as BNPB. This feature empowers users to stay informed and respond more rapidly to emerging threats. The volunteer management system also received high praise, particularly for its clear workflows in registering, approving, assigning, and reporting volunteer activities, filling a critical gap in existing disaster coordination systems. Respondents also noted that the educational content was valuable, practical, and easy to understand, especially in raising awareness of disaster risk reduction and preparedness behaviors.

The donation and logistics modules were equally well-received. Users could easily contribute aid and track its delivery status, increasing transparency and building trust in the system. The interface, built using Flutter and Laravel, was evaluated as intuitive, responsive, and efficient even for non-technical users.

These results confirm that *Aksi Bencana Indonesia* is not only a functional tool for disaster management, but also a meaningful educational instrument. The application's five integrated features work synergistically to provide holistic disaster mitigation support. Moving forward, improvements could focus on expanding integration with government databases, enabling predictive analytics, and supporting broader community outreach.

Splash Screen

The first screen displayed upon launching the *Aksi Bencana Indonesia* application is the **splash screen**, which serves to welcome users and create a sense of community and purpose. This screen features a warm illustration of people joining hands in solidarity, symbolizing cooperation, empathy, and collective action in the face of disaster. Beneath the illustration is a welcome message that briefly introduces the core functions of the app, disaster reporting, donation, logistics, education, and volunteer management, aimed at empowering the community to respond proactively to disaster situations.

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Figure 2. Splash Screen

4.2 Login

This login page allows users who already have an account to enter an encrypted email and password, with the option to view the password via an eye icon, as well as providing a registration feature for new users via email, thus facilitating access to the service in a more flexible manner.

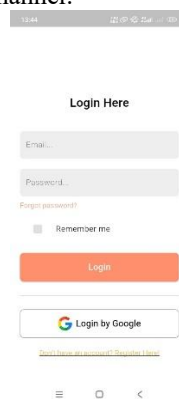


Figure 3. Login

4.3 Dashboard

This page welcomes users back with a “Welcome Back” message and offers the option to join as a volunteer, as well as providing access to various categories such as Data, Donations, Logistics, and Education, which can be searched through the search feature at the top.



Figure 4. Dashboard

Donate

The donation feature allows users to donate funds by viewing an order summary that includes the total donations collected, available payment methods such as bank transfers and e-wallets, and provides the option to enter a mobile number and complete the transaction, so users can contribute easily and quickly to worthy causes.

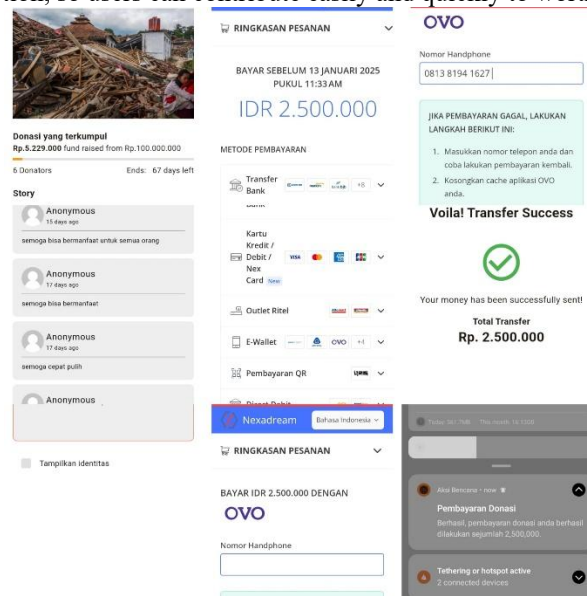


Figure 5. Donate

Data

The BNPB Indonesian Disaster Data Geoportal page displays an interactive map of disaster events in Indonesia with a total of 735 events as of March 23, 2025, including floods, extreme weather, landslides, and the impacts caused such as the number of fatalities, damage to houses, and infrastructure, and provides a crisis monitoring feature through the emergency response dashboard and the InaRISK application to identify the level of vulnerability of an area to disasters.

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Figure 6. Data

Education

The education feature provides important information on disaster mitigation such as tsunamis, earthquakes, and landslides, with clear guidance on steps to take to stay safe, so users can better understand and prepare for emergency situations.

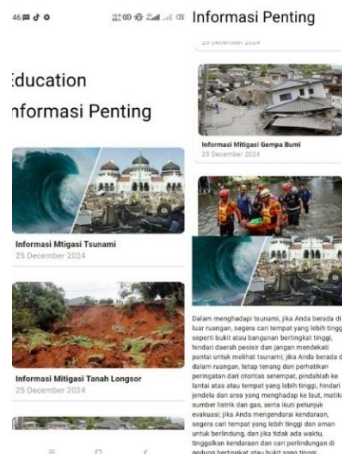


Figure 7. Education

Volunteer

The volunteer feature allows users to register as volunteers in disaster response by filling in personal information, selecting a category or phase of assistance, and uploading identity documents, so that users can contribute directly to disaster management and receive notifications regarding their registration status.

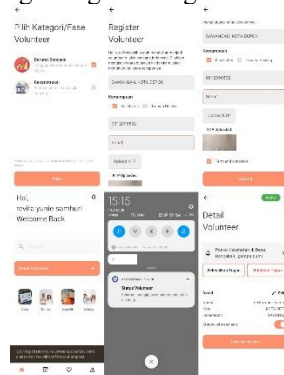


Figure 8. Volunteer

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4.8 Report

The disaster reporting feature allows users to report disaster events by filling in a clear and accurate description, adding a location via a map, and including photos, so that information can be conveyed effectively to help handle disasters, and users will receive a notification of the status of the approved report.

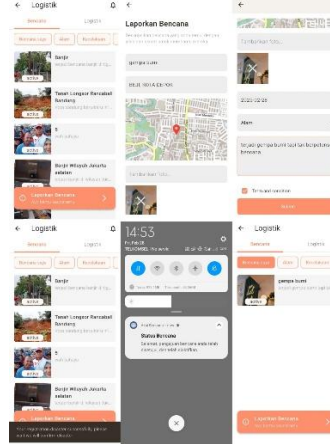


Figure 9. Disaster Reporting

4.9 Logistic

The logistics feature allows users to send aid by filling out a form that includes delivery details, type of aid such as food or clothing, and recipient and courier information, thus facilitating the efficient distribution of aid and users will receive notifications regarding the status of the shipment that has been received.

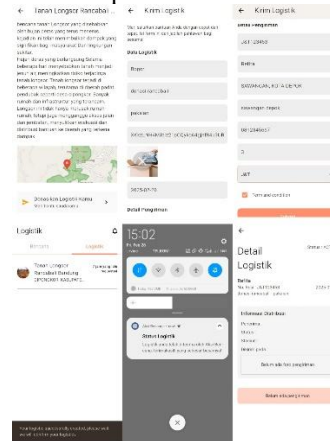


Figure 10. Logistic

Testing

Testing is carried out to ensure the quality and functionality of the Indonesian Disaster Action application in accordance with the specifications that have been designed. Testing includes aspects of functionality verification, performance, security, usability, and system stability through unit, integration, system, and user test (UAT) testing methods. The test results are documented in the form of a bug list, improvement recommendations, and a final report that is used as a basis for further development.

Table 3. Result User Acceptance Test (UAT)

No.	Use Case/Process*)	Success/ Failure	Tested by (**)	Test Date
1	- Test Name: Login/ DFD 1.1. Login - Test Description: Verify access rights can only be accessed by registered users. - Test case: login by google - Expected result:	Success	Ra'uf	16/3/25

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No.	Use Case/Process*)	Success/ Failure	Tested by (**)	Test Date
	- If successful, it will display the main page of the application - If it fails, it will display an error message through the display			
2	- Test Name: Donation Feature - Test Description: Ensure users can make donations for disaster relief. - Test Case: Donation process through the app - Expected result: Donation is successfully processed and confirmation is displayed	Success	Ra'uf	16/3/25
3	- Test Name: Data Features - Test Description: Ensure users can access disaster-related data - Test Case: Accessing the latest disaster data - Expected result: Disaster data is displayed correctly	Success	Divaz	16/3/25
4	- Test Name: Education Feature - Test Description: Ensuring users can access educational materials on disaster management. - Test Case: accessing the education module - Expected result: educational material is displayed properly	Success	Awan	16/3/25
5	- Test Name: Volunteer Feature - Test Description: Ensure users can register as a volunteer - Test Case: Volunteer registration process - Expected result: Volunteer registration is successful and confirmation is displayed	Success	Awan	16/3/25
6	- Test Name: Disaster Report Feature - Test Description: Ensure users can report disaster events - Test Case: Filling in the disaster report - Expected result: Report successfully sent and confirmation displayed	Success	Regar	16/3/25
7	- Test Name: Logistics delivery feature via form - Test Description: ensure users can submit requests for logistics delivery for disaster relief - Test Case: filling in the logistics submission form - Expected result: The request for logistics delivery is successfully submitted and a confirmation is displayed	Success	Dhiha	16/3/25

The User Acceptance Test (UAT) results show that all features in the disaster management application function properly and meet user expectations. Tests on features such as login, donations, data access, education, volunteer registration, disaster reports, and logistics delivery successfully ensure ease of use of the application. With the reliability of these features, this application is ready to be used to support disaster management effectively and efficiently.

DISCUSSIONS

The development of the Aksi Bencana Indonesia application demonstrates a meaningful contribution to improving community preparedness and coordination in disaster response. The integration of five core features, real-time disaster information, volunteer registration and management, donation facilitation, logistics coordination, and educational content addresses significant gaps found in previous disaster management solutions. User Acceptance Testing (UAT) results confirmed that the system met user expectations, particularly in usability, responsiveness, and feature relevance. Respondents expressed that the application was easy to navigate and highly effective in facilitating quick access to information and services during emergencies. Among the most valued features were the volunteer coordination module, which streamlines registration, task assignment, and feedback, and the donation system, which enhances transparency and trust through progress tracking.

Compared to prior systems which focused on individual components such as reporting or early warning notifications this application offers a holistic and user-centered design. The educational component further extends the application's value by supporting disaster literacy, aligning with government strategies for community-based disaster risk reduction. Moreover, the use of real-time data integration with credible sources like BNPB boosts the reliability of information presented to users. However, to maximize its scalability and impact, future improvements

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could include enabling predictive analytics for early warnings, enhancing interoperability with other disaster response platforms, and expanding device compatibility beyond Android systems. Overall, the Aksi Bencana Indonesia application proves to be not only a functional disaster management tool but also a strategic instrument for community empowerment and resilience-building.

CONCLUSION

The development of the Aksi Bencana Indonesia mobile application has proven to be a significant contribution to disaster preparedness and response by integrating five essential features real-time disaster information, donation facilitation, volunteer coordination, logistics management, and educational content into a single platform. The system was developed using Flutter and Laravel and was evaluated through User Acceptance Testing, which showed that users found the application intuitive, responsive, and highly relevant in emergency scenarios. The application's ability to support community engagement, streamline disaster-related processes, and disseminate critical information highlights its practical value for both individuals and organizations involved in disaster management. However, limitations such as its current availability only on Android and the need for broader interoperability with government systems suggest directions for future development.

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