ELKOM (Jurnal Elektronika dan Komputer)
p-ISSN : 1907-0012 (print) e-ISSN : 2714-5417 (online)
Vol. 19, No. 1, Juli 2026
https://journal.stekom.ac.id/index.php/elkom

Development of a WhatsApp-Based Disaster Mitigation Chatbot Using n8n Workflow Automation

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Article Info

Article history:

Received July 9, 2026
Revised July 11, 2026
Accepted July 13, 2026
Available July 14, 2026
Published July 30, 2026

Keywords:

Disaster mitigation
Chatbot
WhatsApp
Workflow Automation n8n
AI Agent

ABSTRACT

Indonesia is one of the countries with a high level of disaster risk, making disaster mitigation information essential for improving community preparedness. However, access to disaster mitigation information is often limited by the need to access specific platforms or applications. This study aims to develop a WhatsApp-based disaster mitigation chatbot using n8n workflow automation and an AI Agent to provide disaster mitigation information automatically and interactively. The research employed a prototype development method consisting of requirements identification, rapid planning, prototype design, implementation, testing, and refinement. The developed system integrates WhatsApp as a communication platform, n8n as a workflow automation tool, and an AI Agent equipped with disaster mitigation knowledge domains. Functional testing results indicate that all main system functions operated successfully, including message reception, question processing, response generation, and response delivery. Response testing also showed that the chatbot was able to provide relevant information within the predefined disaster mitigation domains while rejecting questions outside the specified knowledge boundary. The results demonstrate that the proposed chatbot can serve as an accessible and responsive disaster mitigation education medium through a widely used communication platform. Future development may focus on integrating real-time disaster data and early warning notification features.

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1. INTRODUCTION

Indonesia is one of the most disaster-prone countries in the world due to its complex geographical, geological, hydrological, and climatological characteristics (Ariani et al., 2025). Its location at the convergence of three major tectonic plates and within the Pacific Ring of Fire makes Indonesia highly vulnerable to various types of disasters, including earthquakes, tsunamis, volcanic eruptions,

landslides, floods, and extreme weather events (Aprianti et al., 2023; Huda & Munir, 2025; Utami et al., 2024). According to Indonesian Law Number 24 of 2007 on Disaster Management, disaster management encompasses not only emergency response activities during disasters but also mitigation measures to reduce disaster risks and minimize their impacts (Maulana et al., 2024; Setyorini, 2023). Therefore, enhancing community awareness and preparedness for potential disasters is crucial to achieving sustainable disaster risk reduction.

Disaster mitigation refers to a series of efforts aimed at reducing the potential loss of life, environmental damage, and economic losses caused by disasters. However, the level of public knowledge about disaster mitigation measures varies. Many individuals are still unaware of the appropriate actions to take before, during, and after a disaster. Limited access to timely, easily understandable, and readily available information is one of the factors contributing to low levels of community preparedness for emergencies. In contrast, timely access to disaster mitigation information can help individuals make informed decisions and reduce disaster-related risks more effectively.

Various initiatives to disseminate disaster mitigation information have been undertaken by government institutions and relevant organizations through awareness campaigns, training programs, printed media, and digital platforms. In recent years, advancements in artificial intelligence have facilitated the adoption of chatbots as information-delivery tools that can automatically interact with users in natural language (Reitenbach et al., 2024; Siregar et al., 2026). Previous research has demonstrated that chatbots can enhance information accessibility by providing responsive, continuously available services (Amri et al., n.d.; Hikmawati, 2024). Furthermore, previous studies have highlighted the significant potential of chatbots in supporting digital information services due to their ability to provide rapid and efficient responses (R. S. Putra, 2025; Rifqi et al., 2025). Several studies have reported successful implementations of chatbots across sectors, including education, customer service, healthcare, and public administration, to improve the quality and efficiency of information services.

In the educational sector, chatbots have been utilized to support learning processes and provide automated academic consultation services (Bariah et al., 2022). In the healthcare sector, prior research has shown that chatbots can deliver health-related information promptly and improve user engagement (Amalia & Suprayogi, 2021). In the context of disaster management, several studies have explored the use of chatbots to facilitate risk communication and disseminate emergency information to communities (C. D. Putra et al., 2024). Nevertheless, most existing chatbot implementations are still deployed on web-based platforms or dedicated applications, requiring users to access specific services. This condition may limit access to information for some communities. Although chatbots have proven effective in various domains, their effectiveness depends heavily on the accessibility and familiarity of the platform used to reach users.

WhatsApp is one of the most widely used messaging applications, offering easy access and extensive use in everyday communication. Previous research has demonstrated that WhatsApp is an effective medium for communication and information dissemination due to its wide user base and broad reach. These characteristics make WhatsApp a promising platform for delivering disaster mitigation information to the public (Bariah et al., 2022; Rohman, 2020). Meanwhile, numerous studies have developed chatbots to support disaster-related information services and risk communication. However, most existing implementations are still deployed via web-based platforms or dedicated applications, which require users to access specific services. This limitation may reduce the ease with which communities can obtain disaster mitigation information, particularly in situations that require immediate access to timely and relevant information. Furthermore, the utilization of widely adopted messaging platforms and their integration with workflow automation technologies to provide automated disaster mitigation information services remains relatively limited. These gaps highlight the need to develop a more accessible, responsive, and user-friendly disaster mitigation information service that aligns with the community's communication habits.

Given these challenges, this study aims to design and implement a WhatsApp-based disaster-mitigation chatbot integrated with n8n workflow automation. The n8n platform was selected because it provides a workflow automation platform that enables seamless integration among messaging services, AI processing, and automated response delivery without requiring complex application development. The proposed system is designed to provide disaster mitigation information in a fast, interactive, and easily accessible manner through instant messaging conversations. The contributions of this study include the design of a WhatsApp-based disaster mitigation chatbot architecture, the implementation of n8n workflow automation as a service integration mechanism, and the evaluation of the system's

capability to provide disaster mitigation information to users. Through this approach, the developed system is expected to support more effective dissemination of disaster mitigation information and improve public accessibility to disaster preparedness knowledge.

2. METHOD

This study employed a prototype development approach to design and implement a WhatsApp-based disaster-mitigation chatbot using n8n workflow automation. The prototype method was selected because it enables iterative system development through repeated stages of requirements identification, design, implementation, testing, and evaluation until a system that meets user needs is achieved. This approach also provides flexibility to refine system features, conversation flows, and integration mechanisms based on test results and feedback gathered throughout the development process. The research stages consisted of requirements identification, rapid planning, prototype design, prototype implementation, testing and evaluation, and prototype refinement. Each stage produced outputs that served as inputs for subsequent stages, resulting in a system that fulfills the intended user requirements. The overall research methodology is illustrated in Figure 1.

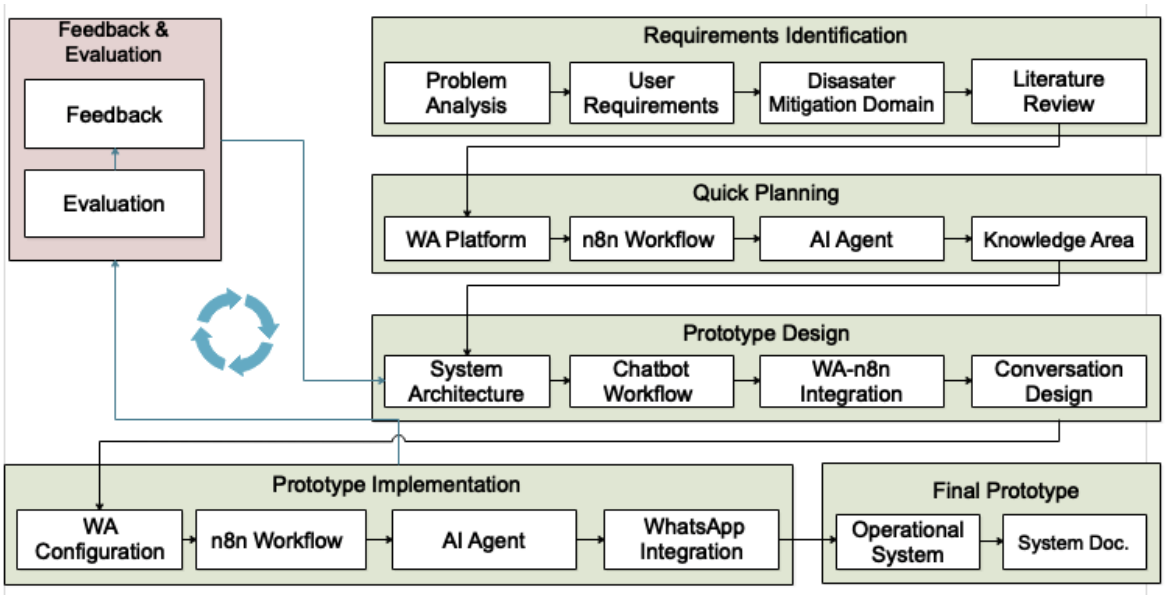

Figure 1. Research Method

2.1. Requirements Identification

Table 1. System Functional Requirements

Functional Requirement	Description
Receive Questions	The system receives disaster mitigation inquiries submitted via WhatsApp.
Process Questions	The system processes user inquiries using the AI Agent.
Generate Responses	The system generates responses based on the predefined disaster mitigation knowledge domain.
Deliver Responses	The system delivers generated responses to users through WhatsApp.

The requirements identification stage was conducted to understand the existing problems and determine the system requirements for the proposed solution. This stage involved analyzing user requirements for disaster mitigation information services, identifying the disaster mitigation knowledge domains to be used by the chatbot, and reviewing the literature on disaster mitigation, chatbots, WhatsApp, and workflow automation. The outcome of this stage was a set of system requirement specifications that served as the foundation for prototype development. The functional requirements of the proposed system are presented in Table 1.

2.2. Rapid Planning

The rapid planning stage was conducted to determine the development approach and technologies to be utilized in the proposed system. During this stage, WhatsApp was selected as the user interaction platform, n8n workflow automation was chosen as the service integration mechanism, and the AI Agent was designated as the question-processing component. In addition, the scope of knowledge to be incorporated into the chatbot was defined. The outcome of this stage was an initial design of the system components to be implemented during prototype development. This stage also involved defining the chatbot's knowledge domains, which would serve as the system's information scope. These domains were categorized based on disaster types that commonly occur in Indonesia and on disaster mitigation information recommended by disaster management agencies. The disaster mitigation knowledge domains adopted in this study are presented in Table 2.

Table 2. Disaster Mitigation Knowledge Domains

Domain	Information Scope
"Banjir"	"Kesiapsiagaan, evakuasi, dan penanganan awal"
"Gempa Bumi"	"Tindakan sebelum, saat, dan setelah gempa"
"Tanah Longsor"	"Mitigasi dan prosedur evakuasi"
"Tsunami"	"Jalur evakuasi dan langkah penyelamatan"
"Kebakaran"	"Pencegahan dan penanganan awal"
"Puting Beliung"	"Tindakan keselamatan dan mitigasi"
"Kesiapsiagaan Keluarga"	"Tas siaga bencana dan rencana evakuasi"

These knowledge domains also serve as boundaries, defining the scope of information the chatbot processes and ensuring that the generated responses remain relevant and aligned with the system's role as a disaster-mitigation education tool.

2.3. Prototype Design

The prototype design stage focused on developing the overall system architecture and operational workflow of the proposed chatbot. This stage involved designing the system architecture, defining the chatbot workflow, establishing the integration mechanism between WhatsApp and n8n, and developing the conversational flow for delivering disaster mitigation information to users. The resulting design served as the blueprint for the subsequent prototype implementation stage.

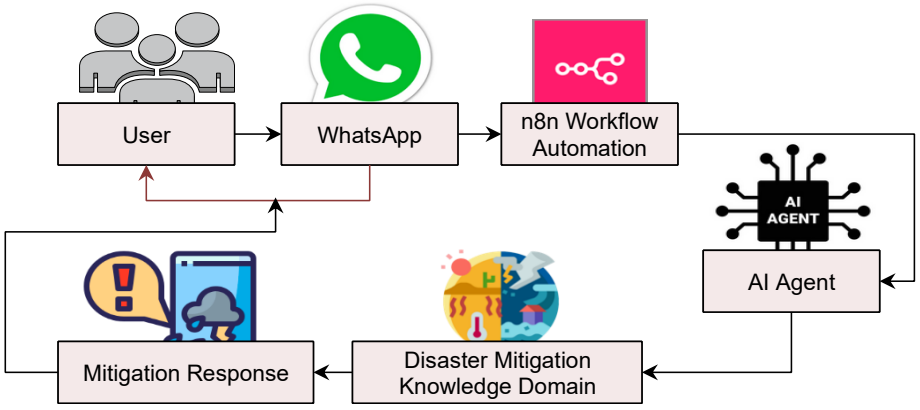

Figure 2. Architecture of the WhatsApp-Based Disaster Mitigation Chatbot System

The proposed system architecture is illustrated in Figure 2. The system is designed by utilizing WhatsApp as the communication platform between users and the chatbot. Users can submit disaster mitigation-related questions through WhatsApp, and the messages are subsequently forwarded to the n8n workflow automation component for further processing. The n8n workflow then sends the user queries to the AI Agent, which is responsible for understanding the context of the questions and generating appropriate responses.

To generate responses, the AI Agent uses predefined disaster-mitigation knowledge domains. These domains encompass information on preparedness, mitigation measures, evacuation procedures,

and emergency actions for several types of disasters that commonly occur in Indonesia. Based on this knowledge, the system generates relevant disaster-mitigation responses and delivers them to users via WhatsApp. Through this architecture, users can obtain disaster mitigation information interactively and automatically via a communication platform that is already integrated into their daily activities.

2.4. Prototype Implementation

The implementation stage involved developing the prototype based on the system design produced in the previous stage. The implementation process included configuring the WhatsApp service, developing the workflow automation using n8n, configuring the AI Agent, and integrating all system components. The outcome of this stage was a chatbot prototype capable of receiving user inquiries and generating automated responses.

The prototype was implemented by integrating WhatsApp, n8n workflow automation, and the AI Agent in accordance with the proposed system architecture. WhatsApp served as the communication medium between users and the system, while n8n acted as the orchestration layer, managing data exchange and workflow automation. The AI Agent was utilized to interpret user inquiries and generate responses based on the predefined disaster mitigation knowledge domains.

2.5. Testing and Evaluation

The testing and evaluation stage was conducted to ensure that the developed prototype met the predefined requirements. The evaluation focused on the core system functionalities, the chatbot's ability to respond to disaster mitigation inquiries, and the integration among system components. The testing results were subsequently evaluated to identify system limitations and determine the necessary improvements. The testing aspects employed in this study are presented in Table 3.

Table 3. System Testing Aspects

Testing Aspects	Description
Functional Testing	Evaluates the core functionalities of the system
Response Accuracy	Assesses the relevance and correctness of chatbot responses
Response Delivery	Evaluates the successful delivery of responses to users
Integration Testing	Assesses the integration among system components

2.6. Prototype Refinement

The prototype refinement stage was carried out based on the evaluation results and feedback obtained during the testing process. Improvements were made to areas requiring further enhancement, including system workflows, integration mechanisms, and chatbot response quality. The outcome of this stage was a refined prototype ready for use as a WhatsApp-based disaster-mitigation information service.

3. RESULT AND ANALYSIS

3.1. Implementation of the Disaster Mitigation Chatbot Prototype

The prototype implementation was carried out based on the system design developed during the previous stages. This phase involved integrating WhatsApp, n8n workflow automation, and the AI Agent to provide an automated disaster mitigation information service. Users can submit disaster mitigation-related inquiries through WhatsApp, after which the messages are processed by the n8n workflow and forwarded to the AI Agent to generate responses based on the predefined disaster mitigation knowledge domains.

The chatbot workflow is illustrated in Figure 3. The workflow begins with receiving messages from users through the WhatsApp Trigger node. The system then performs message validation to ensure that incoming messages can be processed by the chatbot. Messages that pass the validation process are forwarded to the AI Agent for further processing. To generate responses, the AI Agent uses the OpenAI Chat Model as the language processing component and Simple Memory to maintain conversational context throughout user interactions. The generated responses are then delivered to users via the Send

WA Message node, enabling them to automatically receive disaster mitigation information via WhatsApp.

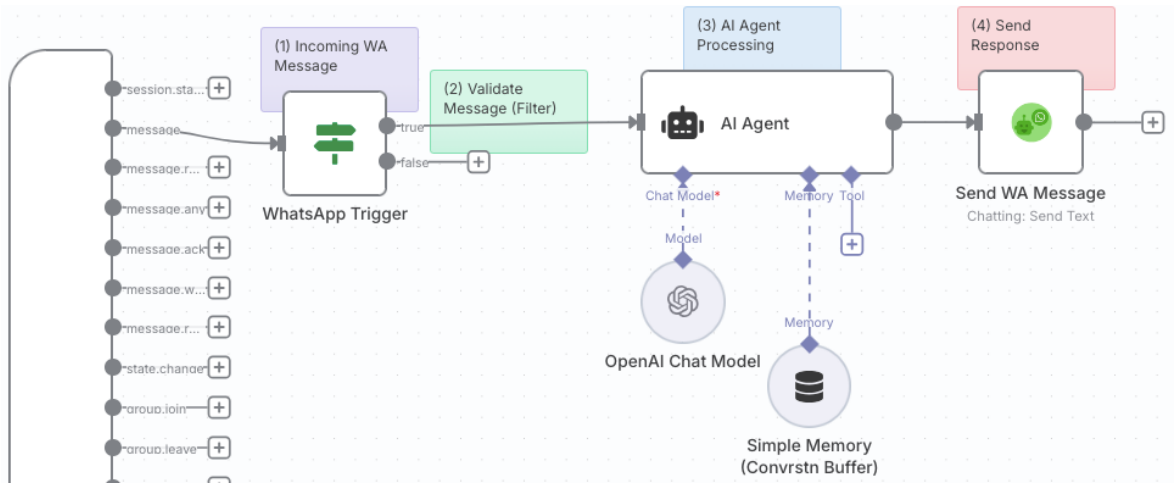

Figure 3. Workflow Automation of the Disaster Mitigation Chatbot

Figure 3 illustrates the proposed workflow, which consists of four main components: message reception, message validation, AI Agent processing, and response delivery. This workflow structure enables the automated delivery of disaster mitigation information without requiring direct operator intervention. As a result, users can obtain relevant disaster mitigation information efficiently through WhatsApp.

3.2. Implementation of Knowledge Domains and AI Agent

The system implementation also involved configuring the AI Agent as the primary component responsible for generating responses to user inquiries. The AI Agent was configured using system instructions that serve as guidelines for understanding and responding to incoming queries. This configuration was designed to enable the AI Agent to serve as a disaster-mitigation assistant, providing information only within its predefined knowledge scope.

The knowledge domains utilized in this study encompass various disaster mitigation topics, including floods, earthquakes, landslides, tsunamis, fires, severe windstorms, and family preparedness. The information provided covers preparedness measures, emergency actions, evacuation procedures, and disaster risk reduction practices. Restricting the knowledge domains was intended to maintain the relevance of generated responses while minimizing the possibility that the chatbot would provide information beyond the system's intended scope.

The AI Agent implementation also incorporates a conversation memory component that enables the system to maintain contextual information throughout an interaction session. This component stores information from previous exchanges, allowing the chatbot to recognize relationships between sequential user inquiries. As a result, the chatbot can consider the context of prior conversations rather than responding to each question independently. This capability is particularly important in disaster mitigation information services, where users frequently submit follow-up questions related to the same topic, such as evacuation procedures, preparedness measures, or recommended actions under specific conditions. By leveraging conversational memory, the system can generate responses that are more consistent, more relevant, and easier for users to understand.

The AI Agent configuration employed in this study is presented in Figure 4. Based on this configuration, the system functions not merely as a general-purpose conversational chatbot but also implements a knowledge boundary focused specifically on disaster mitigation. The knowledge boundary is enforced by restricting the scope of information the chatbot can process and deliver to predefined domains: floods, earthquakes, landslides, tsunamis, fires, severe windstorms, and family preparedness. This approach enables the chatbot to generate responses that are more relevant and better aligned with the system’s objective as a disaster-mitigation education platform.

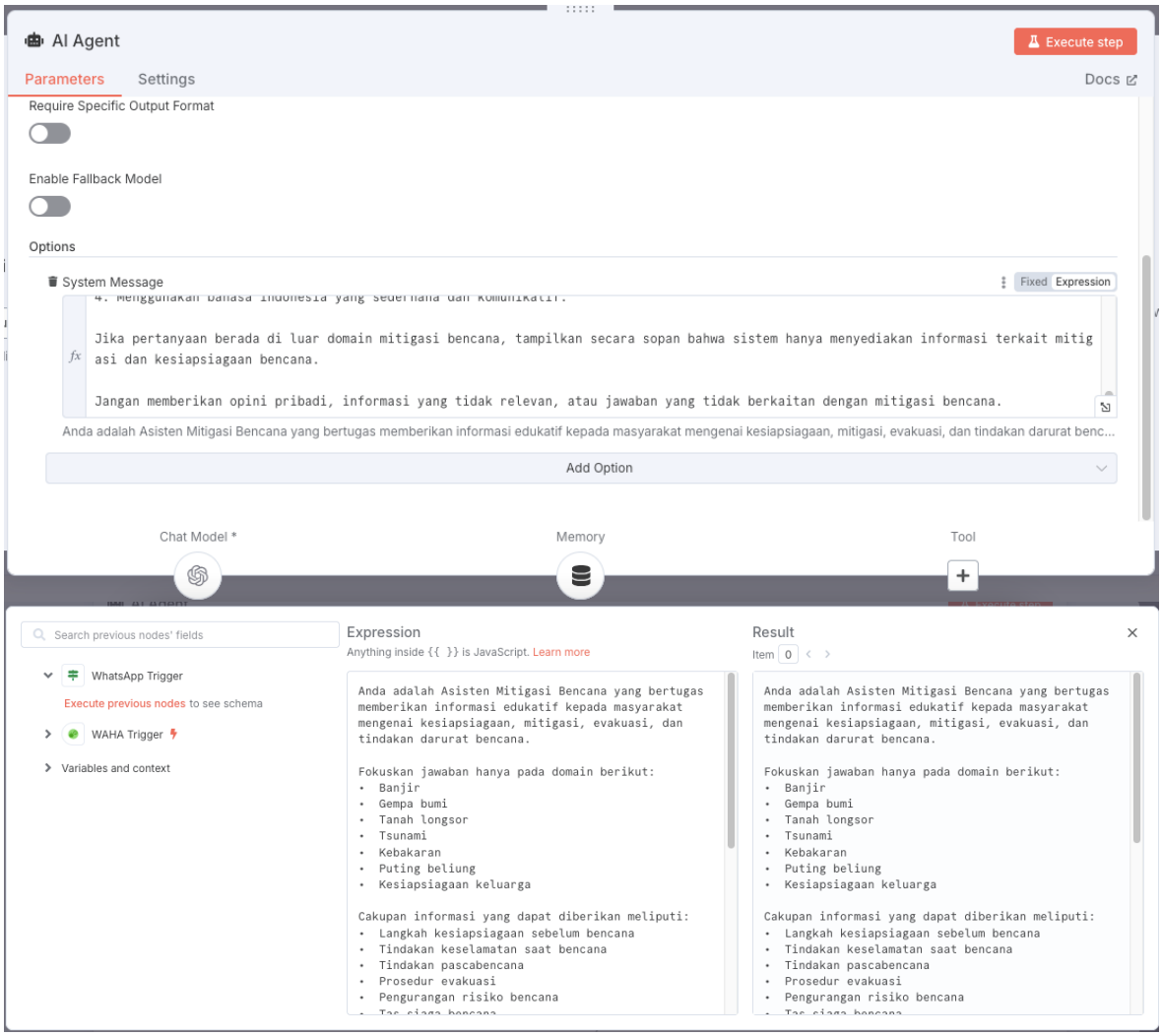

Figure 4. AI Agent Configuration

Beyond enhancing information relevance, implementing knowledge boundaries plays an important role in maintaining response consistency. By limiting the scope of information it can process, the chatbot minimizes the generation of responses that fall outside the disaster mitigation domain, ensuring that the information provided remains focused and aligned with the system's objectives. When combined with the conversation memory mechanism, the knowledge boundary enables the chatbot to deliver responses that are contextually relevant, consistent, and more effective at supporting disaster mitigation education via WhatsApp.

3.3. System Testing Results

System testing was conducted to evaluate the performance of the developed disaster mitigation chatbot and to verify that all core functionalities operated as intended. The evaluation focused on message reception, AI Agent query processing, response generation, and delivery through WhatsApp, as well as the integration among system components. Furthermore, the chatbot's ability to respond within the predefined disaster-mitigation knowledge domains was assessed. The results of the functional testing are presented in Table 4. Each functional component was tested individually to ensure the reliability of the end-to-end communication process, from user message submission to the successful delivery of chatbot responses via WhatsApp.

Table 4. Functional Testing Results

No.	Testing Scenario	Result
1	User submits a question through WhatsApp	Successful
2	Workflow receives the user's message	Successful
3	AI Agent processes the question	Successful
4	System generates a response	Successful
5	Response is delivered to the user via WhatsApp	Successful

Based on the test results presented in Table 4, all primary system functions were successfully executed in accordance with the predefined requirements. The integration of WhatsApp, n8n workflow automation, and the AI Agent successfully enabled the automated delivery of disaster mitigation information without any functional failures during testing. These results indicate that the developed system can handle the entire communication workflow, from receiving user inquiries to automatically delivering responses via WhatsApp. In addition to functional testing, response testing was conducted to evaluate the chatbot's ability to provide responses that were consistent with the predefined disaster mitigation knowledge domains. Several question scenarios were used to assess the relevance of the generated responses to the topics submitted by users. The results of the chatbot response testing are presented in Table 5.

Table 5. Chatbot Response Testing Results

No	User Questions	Status
1	*"Apa yang harus dilakukan saat banjir?"*	Relevant
2	*"Apa yang harus dilakukan saat gempa bumi?"*	Relevant
3	*"Bagaimana mitigasi tanah longsor?"*	Relevant
4	*"Apa yang harus dilakukan saat tsunami?"*	Relevant
5	*"Apa saja isi tas siaga bencana?"*	Relevant
6	*"Siapa presiden Indonesia"*	Rejected (Out of Scope)

The test results indicate that the chatbot generated responses consistent with the predefined knowledge domains. The implementation of the knowledge boundary ensured that the information provided remained within the scope of disaster mitigation, while the conversation memory mechanism supported response consistency throughout ongoing interactions. These findings demonstrate that the developed prototype successfully fulfilled its primary function as a WhatsApp-based disaster mitigation education platform.

Examples of chatbot responses delivered through WhatsApp are presented in Figure 5. As shown in Figure 5(a), the chatbot automatically provided disaster mitigation information in response to user inquiries. The generated responses were presented in a clear, structured manner, enabling users to quickly access preparedness and disaster mitigation information via WhatsApp.

Meanwhile, the result shown in Figure 5(b) demonstrates the effectiveness of the implemented knowledge boundary mechanism. When a user submitted a question outside the predefined disaster mitigation domains, the chatbot did not generate an irrelevant response. Instead, it informed the user that the service was limited to disaster mitigation and preparedness information. This result confirms that the knowledge boundary mechanism effectively maintained the relevance of the information provided while supporting the system's objective as a disaster mitigation education tool. These results suggest that the combination of conversation memory and knowledge boundary mechanisms improves response relevance and consistency, thereby enhancing the chatbot's effectiveness as a disaster mitigation information service.

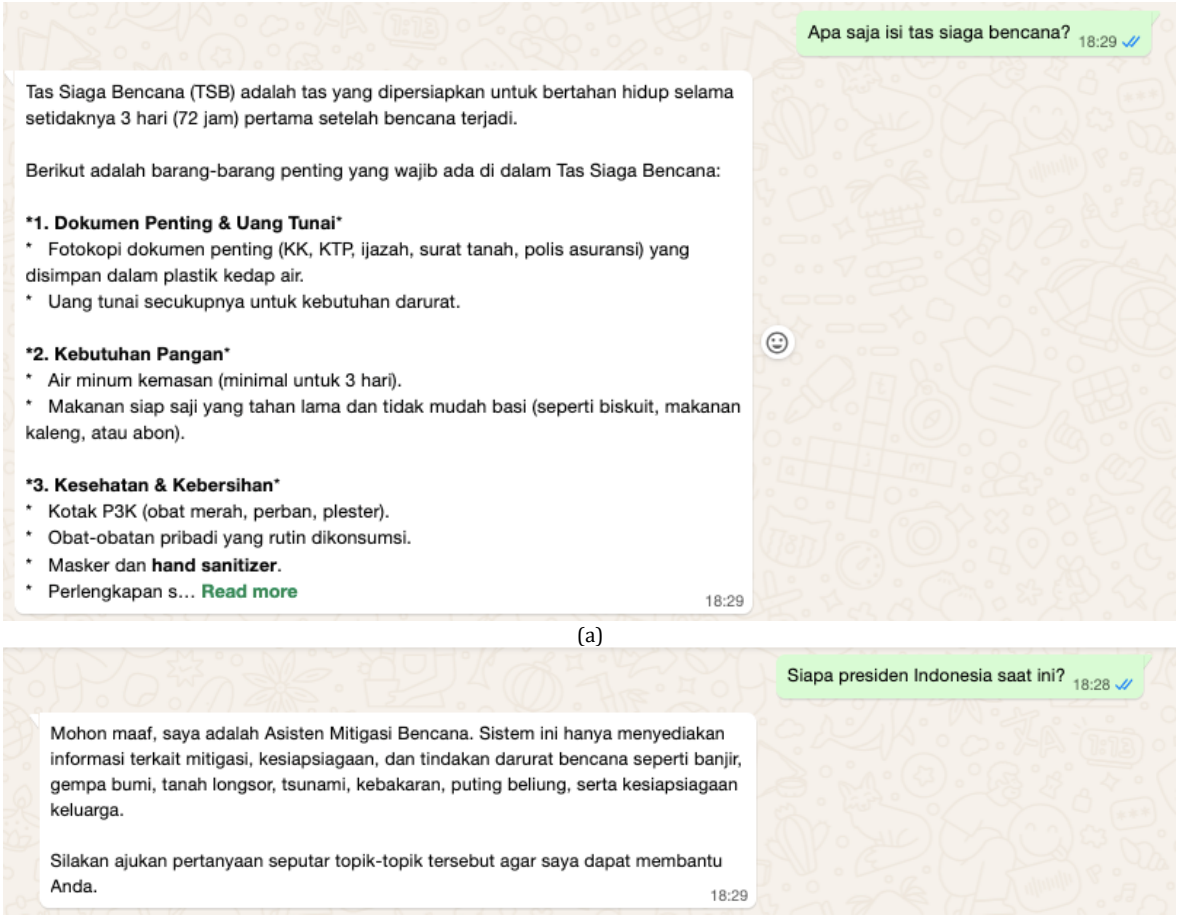

Figure 5. Chatbot Response Examples: (a) Disaster Mitigation Response and (b) Response Outside the Knowledge Boundary

3.4. Analysis and Discussion

The implementation and testing results demonstrate that the developed disaster mitigation chatbot performed all core functionalities in accordance with the proposed design. Using WhatsApp as the interaction platform provides users with convenient access to disaster mitigation information without requiring dedicated applications or specialized platforms. This finding is consistent with previous studies, which identified WhatsApp as an effective communication medium due to its widespread adoption and accessibility across different segments of society (Bariah et al., 2022). By leveraging a platform already integrated into users' daily communication, disaster mitigation information can be delivered more effectively and reach a broader audience.

Furthermore, the integration of n8n workflow automation enables message reception, query processing, and response delivery to occur automatically, without direct operator intervention. The functional testing results indicate that all system components were successfully integrated and operated as intended. This approach supports the provision of responsive and continuously available disaster mitigation information services. In addition, the use of the AI Agent enables the system to automatically generate responses to user inquiries, thereby improving the efficiency and effectiveness of information dissemination.

Based on chatbot response testing results, the knowledge boundary mechanism was found to be effective at maintaining the relevance of the information provided to users. The chatbot was not only able to respond appropriately to disaster mitigation-related questions but also to restrict responses to queries that fell outside the predefined knowledge domains. This finding supports previous research suggesting that chatbots can improve information accessibility through responsive, continuously

available services (Rifqi et al., 2025). Moreover, incorporating conversation memory enables the chatbot to maintain conversational context, resulting in more consistent responses to follow-up questions. These findings indicate that the combination of conversation memory and knowledge boundary mechanisms improves both response relevance and consistency, thereby enhancing the chatbot's effectiveness as a disaster mitigation education tool.

Despite these promising results, the developed system still has several limitations. The chatbot has not yet been integrated with real-time disaster information sources and remains dependent on predefined knowledge domains. Consequently, the information provided is limited to the scope established during system development. Future research may focus on integrating official disaster data sources, location-based services, and automated early warning notifications to further enhance the functionality and practical value of the proposed system.

4. CONCLUSION

This study successfully developed a WhatsApp-based disaster mitigation chatbot prototype, using n8n workflow automation and an AI Agent as its core components. The implementation and testing results demonstrate that the system can receive user inquiries, automatically process information, and provide responses aligned with predefined disaster mitigation knowledge domains. The integration of WhatsApp, n8n, and the AI Agent enables disaster mitigation information to be delivered in an interactive, responsive, and easily accessible manner through a widely used public communication platform.

The implementation of the knowledge boundary mechanism is an important aspect of the proposed system, as it enables the chatbot to provide information relevant to disaster mitigation while restricting responses to queries outside the predefined scope. In addition, using conversation memory helps maintain conversational context, resulting in more consistent responses across user interactions. The testing results indicate that all core system functions operated successfully and effectively supported the automated delivery of disaster mitigation information through WhatsApp. Therefore, the proposed system has the potential to serve as a disaster-mitigation education tool that can improve public access to preparedness and disaster risk-reduction information. Future research may focus on integrating real-time disaster information sources, location-based services, and automated early warning notification features to further enhance the functionality and practical value of the proposed system in supporting disaster mitigation efforts.

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