



Localized Cebuano-English DRRM Chatbot via Retrieval-Augmented Generation and Large Language Models

Catherine A. Pilongo, LPT ¹
catherine.pilongo@nmsc.edu.ph
0009-0009-1322-0591

Leslyn B. Reazol, MIT ¹
leslyn.reazol@nmsc.edu.ph
0009-0006-0230-1837

1 – Northwestern Mindanao State College of Science and Technology

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Abstract

The study created and assessed a localized Cebuano-English Disaster Risk Reduction and Management chatbot using Retrieval-Augmented Generation and Large Language Models. It responded to residents' demand for clearer disaster communication, especially on typhoons, floods, evacuation instructions, emergency hotlines, go-bag preparation, and weather warnings. A developmental-descriptive research design was adopted in the investigation. The developmental aspect consisted of the design and deployment of a web-based chatbot prototype. The descriptive aspect evaluated current DRRM communication methods and user approval using the Technology Acceptance Model.

The system was built using an embedding-based RAG architecture. Knowledge entries from DRRM were sorted into structured knowledge chunks and stored in a repository, where they were transformed into embeddings and retrieved using vector-based search. The LLM produced localized Cebuano-English responses using only the approved retrieved knowledge. Also, the system has manual ingestion of Advisories and review by Admin/MDRRMO to guarantee only validated content is used by the chatbot.

Results showed that the top hazards of the respondents are typhoons and floods. Most residents' sources of DRRM information are radio, barangay announcements, MDRRMO/LGU alerts, and social media. The results also revealed that the respondents favored Cebuano or



Cebuano-English explanations, particularly for technical terms related to disasters. The TAM evaluation demonstrated a very high initial acceptability among users, with an overall grand mean of 4.45. This shows that the respondents regarded the chatbot as useful, easy to use, and acceptable as an additional DRRM communication support tool. The study said the chatbot can be useful for municipal and barangay DRRM communication, but it should not replace official advisories, evacuation orders, or emergency decisions given by authorized agencies.

Keywords: *DRRM chatbot; Cebuano–English; Retrieval-Augmented Generation; Large Language Model; Technology Acceptance Model*



1. Introduction

Disaster Risk Reduction and Management communication plays an important role in helping communities prepare for, respond to, and recover from disasters (Reduction, 2015). In the Philippines, communities are frequently exposed to hazards such as typhoons, floods, and other weather-related emergencies (Council, 2020; Republic Act No. 10121: Philippine Disaster Risk Reduction and Management Act of 2010, 2010). Although official advisories are regularly issued by agencies such as PAGASA, NDRRMC, and local government units, many residents in rural communities may still experience difficulty understanding disaster information when messages are written in highly technical language or in languages not commonly used in their locality.

In Cebuano-speaking barangays, disaster advisories written mainly in English or Filipino may not always be easily understood by residents. Technical terms such as rainfall warning, storm surge, tropical cyclone wind signals, evacuation advisory, and emergency preparedness may require simpler and more localized explanations (PAGASA, n.d.). Because of this, there is a need for a communication support tool that can explain official DRRM information in Cebuano–English using clear, short, and practical responses.

Current developments in Artificial Intelligence, particularly Large Language Models and Retrieval-Augmented Generation, offer opportunities to build chatbot systems that can respond to users in natural language while grounding their responses in approved knowledge sources (J. Brown & Smith, 2021; Lewis, 2020; Vaswani et al., 2017). RAG allows the chatbot to retrieve relevant content from a verified DRRM knowledge repository before generating responses (Lewis, 2020). This helps reduce unsupported answers and improves the relevance of chatbot responses in safety-critical contexts such as disaster communication.

This paper built and assessed a local Cebuano-English DRRM chatbot using RAG and LLMs. Specifically, it sought to: delineate the existing condition of DRRM communication in selected barangays; establish a localized DRRM knowledge repository; create and carry out a chatbot prototype; assess user acceptance via the Technology Acceptance Model (Davis, 1989);

and suggest a preliminary framework and guidelines for the integration of AI-assisted localized chatbots in municipal DRRM communication.

2. Materials and Methods

2.1 Research Design

The study was designed as a descriptive developmental study. The development phase involved designing and implementing a localized Cebuano-English DRRM chatbot prototype using Retrieval-Augmented Generation and Large Language Models (T. B. Brown et al., 2020; Lewis, 2020). The descriptive part involved determining current DRRM communication practices in the chosen barangays and the initial user acceptance of the chatbot using the Technology Acceptance Model.

2.2 Participants

The study participants were the residents of selected barangays in Tambulig, Zamboanga del Sur, who interacted with the chatbot prototype. The study also recruited key informants, such as local DRRM workers and barangay officials, who provided comments on DRRM communication methods and the possible usage of the chatbot as an additional communication support tool.

2.3 Instruments

The study used a baseline DRRM communication survey, a TAM-based user approval questionnaire, and a key informant interview guide. The TAM questionnaire was used to examine perceived usefulness, perceived ease of use, attitude toward usage, and behavioral intention to use (Davis, 1989). Supporting documentation, such as system-related resources (e.g., DRRM knowledge repository, chatbot interaction examples, and prototype screenshots), was also used.

2.4 Procedure

The study started with a review of the existing DRRM communication strategies in the selected barangays. Official and approved DRRM knowledge resources were collected, compiled, and localized into Cebuano-English knowledge chunks from sources such as PAGASA, NDRRMC, LGUs/MDRRMOs, and barangay DRRM publications (Council, 2020; PAGASA, n.d.; Republic Act No. 10121: Philippine Disaster Risk Reduction and Management Act of 2010, 2010). The elements were stored in a repository and transformed to vector embeddings for retrieval (Lewis, 2020). The chatbot prototype was built and tested internally before being released to a limited group. After testing, the respondents completed the TAM-based questionnaire, and the key informants were contacted for input.

2.5 Data Analysis

Frequency, percentage, mean, and standard deviation were used to analyze quantitative data. A verbal interpretation scale was used to figure out the level of user acceptance from the TAM data. The themes in the qualitative responses from key informants were used to identify common ideas, problems, and suggestions for using the chatbot for local DRRM communication.

3. Results

3.1 Current State of DRRM Communication

The results showed that typhoons and floods were the most frequent risks experienced by the respondents. Residents were informed about DRRM by radio, barangay announcements, MDRRMO/LGU advisories, social media, and information supplied by local officials or community members. Some respondents, however, pointed out that catastrophe advisories were sometimes difficult to understand, especially when written in technical language or not translated into Cebuano.

Results also showed that residents preferred explanations in Cebuano or Cebuano-English for information regarding catastrophes. This shows the importance of local language support in

understanding DRRM recommendations, particularly in rural areas where Cebuano is commonly used in daily conversations.

3.2 Development of the Localized DRRM Knowledge Repository

The study produced a localized DRRM knowledge store consisting of structured knowledge bits. These portions included disaster-related material on typhoons, floods, evacuation, emergency hotlines, go-bag preparation, weather alerts, and readiness suggestions. The repository was based on official and approved sources such as PAGASA, NDRRMC, LGU/MDRRMO warnings, and barangay DRRM materials.

Each knowledge chunk had essential metadata, including hazard type, disaster phase, source, original material, localized Cebuano–English content, and approval status. The repository was built to make sure that only approved knowledge chunks were fetched and used by the chatbot.

3.3 Design and Implementation of the RAG–LLM Chatbot Prototype

The chatbot prototype was developed as a web-based system. This consisted of a resident-facing chat interface and an administrative interface for maintaining DRRM knowledge entries. The system uses an embedding model to turn user queries and bits of knowledge into vectors. An acceptable knowledge chunk retrieval was performed via a vector database. The LLM then produced localized Cebuano–English replies from the recovered chunks.

The prototype also featured a manual Advisory Ingest. This enabled authorized staff to add or upload fresh advisory content. The system might help parse and localize the advice into draft knowledge chunks; however, these entries remained pending until they were evaluated and approved by the Admin or MDRRMO reviewer. This procedure helps to ensure the chatbot will not use unsubstantiated or unapproved content.

Figure 1

Chatbot User Interface

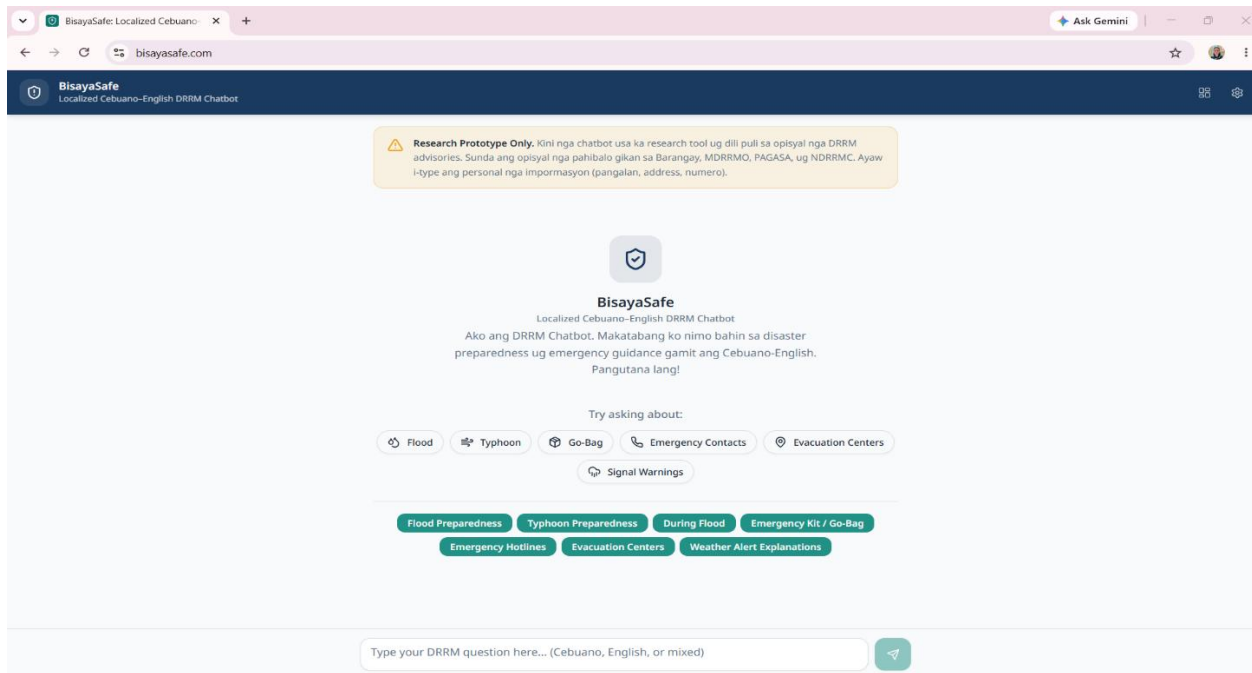


Figure 1 presents the resident-facing chatbot interface of the localized Cebuano–English DRRM chatbot. The interface allows users to enter disaster-related questions in Cebuano, English, or mixed language. It also provides quick prompt buttons for common DRRM concerns such as flood preparedness, typhoon preparedness, go-bag preparation, emergency hotlines, and evacuation center information. This interface serves as the main access point for residents to obtain localized and understandable DRRM guidance.

Figure 2

Sample Chatbot Response



BisayaSafe
Localized Cebuano-English DRRM Chatbot

Research Prototype Only. Kini nga chatbot usa ka research tool ug dili puli sa opisyal nga DRRM advisories. Sunda ang opisyal nga pahibalo gikan sa Barangay, MDRMO, PAGASA, ug NDRRMC. Ayaw H-type ang personal nga impormasyon (pangalan, address, numero).

Unsay angay buhaton aron makapangandam sa baha?

Para makapangandam sa baha, sunda kini nga mga lakang:

1. **Andam og Go-Bag.** Kinahanglan adunay tubig (1 gallon per person per adlaw for 3 days), dili daling madaot nga pagkaon, flashlight, batteries, first aid kit, whistle, kopya sa IDs, kwarta, phone charger, ug importante nga tambal.
2. **Kail-a ang dalan ug evacuation center** sa inyong lugar.
3. **Monitor ang advisories sa PAGASA.**
4. **Charge ang inyong phone ug power bank.**

Reminder: Kini research prototype lamang. Sunda gihapon ang opisyal nga instruksyon sa Barangay, MDRMO, PAGASA, ug NDRRMC.

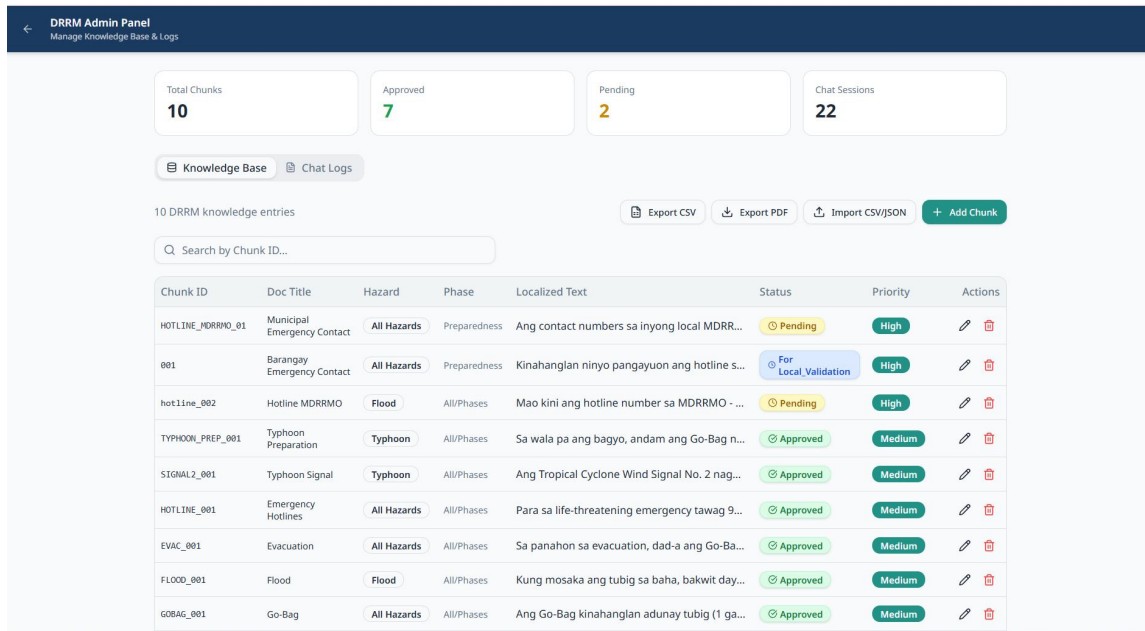
Flood Preparedness | Typhoon Preparedness | During Flood | Emergency Kit / Go-Bag
Emergency Hotlines | Evacuation Centers | Weather Alert Explanations

Type your DRRM question here... (Cebuano, English, or mixed)

Figure 2 shows a sample interaction between the user and the chatbot. In the example, the user asks a DRRM-related question, and the chatbot provides a localized Cebuano–English response. The response is presented in a clear and step-by-step manner to help residents understand what actions to take. This demonstrates how the chatbot uses approved DRRM knowledge chunks to generate practical disaster guidance for users.

Figure 3

Knowledge Repository Dashboard



The DRRM knowledge chunks management knowledge repository dashboard is shown in Fig. 3. The dashboard displays saved items, including identification of the chunk, source, type of danger, phase of the catastrophe, localized language, approval status, and priority level. It also has facilities for finding, adding, importing, exporting, amending and deleting knowledge entries. This dashboard is meant for storing and maintaining the approved DRRM content utilized by the chatbot.

Figure 4

Advisory Review or Approval Dashboard

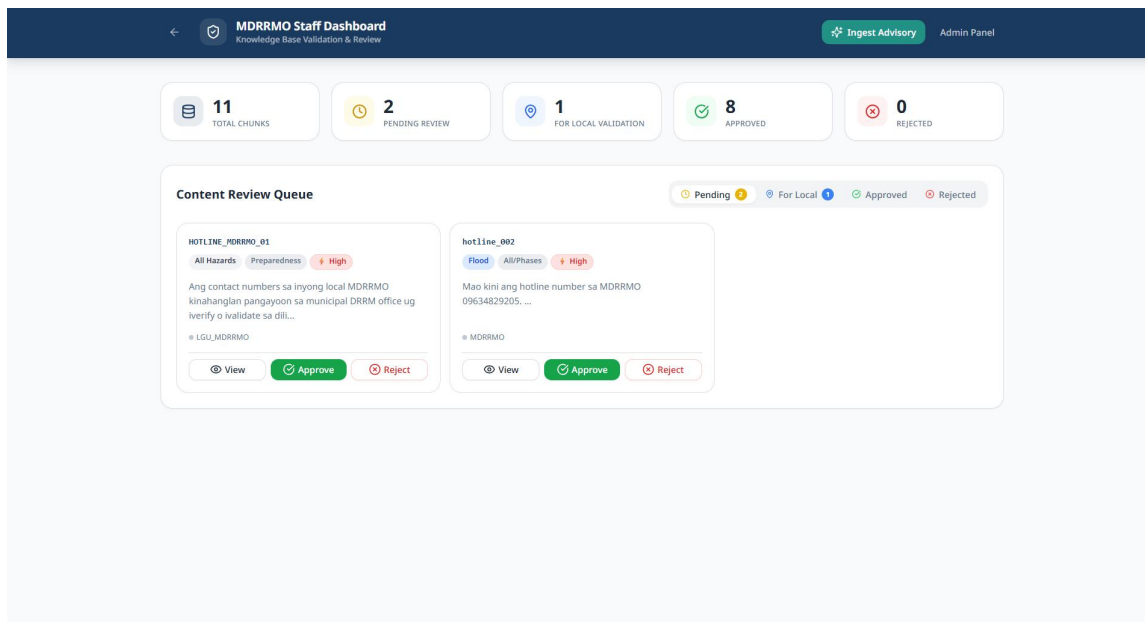


Figure 4 shows the dashboard for advisory review or approval for Admin/MDRRMO validation. This interface enables reviewers to check pending advisory entries before they are approved for usage by chat bots. The dashboard lets you examine actions to see, approve or reject submitted content. With this functionality, the chatbot can retrieve only DRRM information that has been reviewed and approved.

3.4 User Acceptance Evaluation Using TAM

The TAM-based evaluation showed a very high level of initial user acceptance(Davis, 1989). The respondents rated the chatbot highly in terms of perceived usefulness, perceived ease of use, attitude toward using, and behavioral intention to use.

TAM Construct	Mean	Interpretation
Perceived Usefulness	4.49	Very High
Perceived Ease of Use	4.37	Very High
Attitude Toward Using	4.48	Very High
Behavioral Intention to Use	4.44	Very High
Overall Grand Mean	4.45	Very High

The overall grand mean of 4.45 indicates that the respondents perceived the chatbot as useful, easy to use, and acceptable as a supplementary DRRM communication support tool.

4. Discussion

The results indicate that localized disaster communication is a feasible technique in rural areas of Cebuano-speaking people(Council, 2020). Disaster information is sourced by households from several channels. The use of technical, nonlocalized language may hinder residents' comprehension of government advisories. The usage of Cebuano or Cebuano-English explanations shows the significance of communication tools that could translate or interpret DRRM materials into a language spoken and understood by the public.

The creation of the DRRM knowledge repository has helped to systematically organize official disaster-related information into knowledge chunks that can be easily retrieved. This is important because the chatbot doesn't only rely on general AI-generated responses. Instead, it pulls approved information from the repository and then produces responses(Lewis, 2020). This approach produces more realistic responses and enables safer communication in a DRRM context.

The strong TAM scores show the chatbot was warmly received by respondents(Davis, 1989). The very high grade for perceived utility shows that inhabitants saw the chatbot's ability



to help them interpret disaster information. The very high score for perceived ease of use indicates that, in general, the users found the chatbot interface easy to learn and use. The evaluation of favorable attitudes and behavioral intentions also suggests that residents may be eager to use the chatbot as an alternative source of DRRM information.

However, the chatbot should not be treated as a replacement for official advisories, evacuation orders, or emergency decisions from authorized agencies (Council, 2020; Republic Act No. 10121: Philippine Disaster Risk Reduction and Management Act of 2010, 2010). It should only serve as an AI-assisted communication support tool. The Admin/MDRRMO review mechanism is therefore an important feature because it ensures that only verified and approved knowledge chunks are made available for chatbot retrieval.

5. Conclusion

This study was able to effectively construct and assess a localized Cebuano-English DRRM chatbot using Retrieval-Augmented Generation and Large Language Models. The chatbot was developed to deliver resident-friendly disaster information using approved DRRM knowledge pieces. It has a well-designed DRRM knowledge library, vectorized search, localized LLM-generated answers, manual advisory ingestion, and Admin/MDRRMO evaluation.

Findings showed that typhoons and floods were the most commonly experienced hazards among the respondents. Residents commonly received disaster information through radio, barangay announcements, MDRRMO/LGU advisories, and social media. The results also showed that respondents preferred Cebuano or Cebuano-English explanations, especially when technical disaster terms were involved.

The TAM-based evaluation showed a very high level of initial user acceptance, with an overall grand mean of 4.45. This indicates that the chatbot was perceived as useful, easy to use, and acceptable as a supplementary DRRM communication support tool. The study concludes that the localized Cebuano-English DRRM chatbot may support municipal and barangay DRRM communication. However, it should not replace official advisories, evacuation orders, or



emergency response decisions issued by authorized agencies(Council, 2020; Republic Act No. 10121: Philippine Disaster Risk Reduction and Management Act of 2010, 2010).

Recommendations

The findings of the study recommend augmenting the DRRM knowledge repository by including new validated hazard subjects such as landslide, earthquake, fire events, storm surge, and high heat. Further enhance advisory ingestion ability to handle more file types and offer a more holistic review approach.

It is also recommended that the Admin/MDRRMO review dashboard be enhanced by adding options such as approve, reject, edit, return for revision, and mark for local validation. Additional safety mechanisms should be added to further reduce unsupported responses, especially for emergency-related questions.

Future researchers may conduct a more extensive evaluation that encompasses a greater number of barangays and respondents. Longitudinal studies, real-world behavioral impact, isolated or low-connectivity support, and combinations with official advice sources when feasible are potential components of future research.

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