Chapter I

THE PROBLEM AND ITS SCOPE

Introduction

Rationale of the Study

Natural disasters are a significant cause of fatalities and economic loss (U.S. Department of Homeland Security, 2025). It poses significant challenges to all that have been affected. Thus, the ability to respond swiftly and effectively is crucial to minimizing damage, saving lives, and ensuring continuity of essential services. However, the people embracing traditional disaster response mechanisms often have imposed challenges in coordination, resource allocation, and communication. During crises, disaster response efforts around the world face significant challenges like inefficiency, miscommunication, and poor coordination between different organizations. According to the United Nations Office for Disaster Risk Reduction (UNDRR), when disaster response agencies don't work together, it can lead to slow distribution of resources and delays in providing help to those in need. The UNDRR also points out that response efforts often struggle with not sharing data quickly enough and slow decision-making, especially in areas where communication systems are damaged or overwhelmed (UNDRR, 2020).

With communication systems overwhelmed, these issues are even more noticeable in the Philippines. The Philippine Disaster Resilience Foundation (PDRF) reports that only 26% of disaster response systems in the country are fully integrated, with many local government units (LGUs) still using outdated methods like paper records, spreadsheets, and separate databases (PDRF, 2021). This lack of coordination leads to slower resource deployment, limited real-time communication, and poor tracking of volunteer efforts and donations. Additionally, the Philippine Red Cross (2022) highlights the difficulty in organizing large volunteer groups during disasters due to the lack of a single platform for communication and task management. These inefficiencies not only delay help but also make it harder to manage supplies, personnel, and donations, making the impact on communities worse. With climate-related disasters becoming more frequent and severe, the need for a more organized, data-driven approach to disaster response is more urgent than ever.

Despite the urgent need for improved disaster response mechanisms, several research gaps remain. Most disaster response efforts rely on fragmented systems such as spreadsheets, paper records, and separate databases, leading to inefficiencies. For instance, local government units (LGUs) in the Philippines often rely on outdated methods, including paper-based records and standalone databases, which hinder effective coordination and timely response during disasters (Cruz, 2024). Additionally, Biñas and Mercado (2024) revealed that real-time disaster tracking and decision-making technologies are still underused, and most existing research tends to focus on post-disaster evaluation rather than real-time response systems. Their study suggests that incorporating real-time analytics can drastically enhance disaster preparedness and operational decisions. Moreover, studies on digital volunteer coordination platforms within the Philippine context remain limited, making it difficult to mobilize and manage volunteer efforts efficiently during crises which lead them to recommend that systems be designed with accessibility in mind and be accompanied by strong training components to increase local adoption (Coughlin, et al., 2016). Furthermore, there is a lack of research on how technology can enhance coordination between LGUs and non-governmental organizations (NGOs) in disaster response. This is particularly concerning given that many existing digital disaster response systems may not be fully accessible to all stakeholders, especially those in remote areas with limited internet connectivity (Alampay, et al., 2021). The Philippine Disaster Resilience Foundation (PDRF) also highlights that many LGUs still use outdated methods, making resource deployment slower and inefficient (PDRF, n.d.). Moreover, the adoption of new digital solutions in disaster response faces challenges such as resistance to change, lack of training, and technological constraints (Alampay, et al., 2021). Addressing these research gaps is crucial in developing a more effective, integrated, and data-driven disaster response system.

With this urgency, the Integrated Disaster Response Information System (IDRIS) is a digital platform designed to solve these problems by streamlining and automating key aspects of disaster response. It brings together functions like volunteer management, donation tracking, resource distribution, damage assessment, and logistics coordination into one system, offering real-time data for decision-makers. Developed for the Ramon Aboitiz Foundation Inc. (RAFI), IDRIS will be available on both web and mobile platforms, ensuring responders can access vital information wherever they are. By integrating these functions into one system, IDRIS will make disaster response more effective, improve coordination between organizations, and ensure that aid reaches those in need as quickly as possible. The system will allow RAFI and other disaster response teams to manage every part of the response from one interface, reducing delays, improving data visibility, and ensuring resources are used effectively (Dharmaraj, 2024).

The implementation of IDRIS works seamlessly to enhance the disaster response process that will be carried out by Ramon Aboitiz Foundation Inc. (RAFI), enhancing collaboration between different stakeholders, ensuring that the right resources are deployed at the right time, thereby improving the effectiveness of disaster relief efforts with volunteers and donations. This system integrates modules for LGU Profiling, Volunteer Management, Donation Management, Damage Assessment, and other critical operations, ensuring efficient decision-making processes and resources are optimally deployed during crises (Lacasandile & Labanan, 2020).

During crises, it is essential for IDRIS to address the aforementioned problems. The primary purpose of IDRIS is to enhance the efficiency and effectiveness of disaster response efforts by providing a unified system that consolidates real-time data, communication, and logistics management. This integration aims to improve coordination among local government units (LGUs), volunteers, donors, and emergency responders, facilitating timely and effective disaster management (Padagdag, J., 2018). The system seeks to increase efficiency by automating essential processes such as volunteer registration, donation tracking, and resource allocation, ensuring faster and more organized disaster response efforts (CADRI, 2020). Additionally, IDRIS supports improved decision-making by providing data-driven insights and reports, enabling informed choices regarding resource distribution and response prioritization. The platform also optimizes resource allocation by utilizing location-based data and mapping features to deploy volunteers, donations, and relief goods effectively to the most affected areas. Moreover, IDRIS promotes transparency and accountability by tracking the status of donations, supplies, and operational updates in real-time, addressing the common issue of fragmented data and improving multi-sectoral disaster response coordination (CADRI, 2020). By addressing these objectives, IDRIS aims to overcome the limitations of current disaster response practices, equipping RAFI with a powerful tool to deliver well-coordinated, timely, and data-informed responses to future disasters.

Objectives

This study aims to **design and develop** a centralized system for managing disaster response activities, focusing on the integration of donation tracking, logistics coordination, and financial oversight. The system, referred to as the Integrated Disaster Response Information System (IDRIS), will serve as a unified platform to streamline key disaster management processes. Through its development, the platform is expected to support efficient resource allocation and promote financial transparency among various stakeholders involved in emergency response.

Furthermore, the study seeks to **implement** real-time monitoring and reporting features that will enhance decision-making and operational efficiency during relief efforts. This includes live dashboards, automated reporting mechanisms, and the real-time tracking of donations and logistics to ensure responsive and informed actions. In addition, the system will **integrate and deploy** multiple disaster response functions—such as procurement, inventory management, packing, warehousing, and distribution—within a single framework. This functional integration is designed to optimize logistics operations, minimize delays, and ensure that essential supplies are delivered to affected areas effectively.

To **enhance transparency and accountability**, the system will maintain detailed and auditable records of resource inflows, outflows, and allocations. These records will be evaluated continuously using data analytics, audits, and stakeholder feedback to identify opportunities for improvement and to maintain the system's integrity and reliability. Finally, the study will **evaluate** the overall effectiveness of IDRIS in improving coordination among stakeholders by assessing its ability to facilitate seamless communication and collaboration. User engagement metrics, system analytics, and qualitative feedback will guide the refinement of the platform to ensure its alignment with the evolving demands of disaster response and management.

Review of Related Literature

Disaster response refers to the immediate and coordinated efforts undertaken to mitigate the impact of natural or man-made disasters on affected communities (Haddow, Bullock, & Coppola, 2021). It includes activities such as search and rescue, emergency relief, damage assessment, and resource distribution. Effective disaster response relies on coordination, timely communication, and efficient resource management to minimize casualties and economic losses (UNDRR, 2020).

Coordination in disaster response refers to the systematic management of activities among various stakeholders, including government agencies, non-governmental organizations (NGOs), and local communities, to ensure an effective and unified response (Alexander, 2018). Poor coordination leads to delayed assistance, inefficient use of resources, and redundancy in efforts. The United Nations International Strategy for Disaster Reduction (UNISDR, 2020) highlights the importance of interoperability between disaster response organizations to improve the speed and effectiveness of aid distribution.

Communication systems in disaster response facilitate information exchange among responders, decision-makers, and affected communities. According to Kumar and Havey (2021), integrating Information and Communication Technology (ICT) in disaster response improves real-time decision-making and data sharing. The World Bank (2021) identifies major communication challenges in developing countries, such as the Philippines, due to outdated infrastructure and the reliance on manual reporting systems.

Information and Communication Technology (ICT) plays a crucial role in modern disaster management by enabling automated processes, real-time data tracking, and efficient resource allocation (Liu et al., 2019). Digital platforms such as Geographic Information Systems (GIS) allow emergency responders to map disaster-affected areas and optimize response efforts (Fernandez & Ahmed, 2020). The integration of cloud computing and mobile applications further enhances response efficiency by enabling quick access to critical information (Park & Lee, 2019).

One widely recognized system is the Disaster Response and Recovery Management System (DRRMS), which integrates emergency response functions into a single interface. Research by Rajan and Srivastava (2021) found that real-time crowd-sourced data platforms such as the Sahana Disaster Management System enhance situational awareness and improve coordination among relief agencies.

The Philippines is highly vulnerable to natural disasters, including typhoons, earthquakes, and floods, making disaster response a critical national priority (PDRF, 2021). Despite ongoing efforts, the Philippine Red Cross (2022) reports that many local government units (LGUs) continue to rely on outdated methods, such as paper-based records and manual coordination, leading to inefficiencies in resource deployment.

To address these challenges, digital transformation initiatives such as the Department of Science and Technology's (DOST) Project NOAH (Nationwide Operational Assessment of Hazards) have been introduced to enhance disaster preparedness through real-time hazard mapping and early warning systems. However, challenges in implementation, integration, and stakeholder engagement persist (DOST, 2022).

Review of Related Studies

Several studies have explored the role of ICT in improving disaster response efficiency. Lacasandile and Labanan (2020) conducted a study on the use of an Integrated Disaster Response System in Southeast Asia and found that such systems significantly improve communication and resource allocation. Their findings highlight that integrating real-time data analytics into disaster management systems leads to more effective decision-making.

Similarly, a study by Kim et al. (2019) examined the impact of mobile-based disaster response platforms in South Korea. Their research concluded that mobile applications designed for real-time reporting, volunteer coordination, and donation tracking reduced response times by 35% and improved overall efficiency. The study emphasizes the importance of user-friendly interfaces and stakeholder collaboration in ensuring successful adoption. GIS and data analytics have also been widely studied for their role in disaster response. A study by Wang and Zhao (2020) demonstrated how GIS-based disaster mapping significantly improved response times during the 2019 floods in China. By utilizing geospatial data, disaster response teams were able to prioritize affected areas and deploy resources more effectively.

Moreover, Rajan and Srivastava (2021) analyzed the use of artificial intelligence (AI) and machine learning in disaster response. Their findings suggest that AI-driven predictive modeling can enhance disaster preparedness by forecasting disaster impact zones and recommending optimal response strategies. This aligns with the need for more data-driven decision-making in disaster response efforts worldwide. Several case studies provide insight into the development and implementation of integrated disaster response systems. A study by Park and Lee (2019) focused on the South Korean Emergency Response Coordination System (ERCS), which combines multiple disaster response functionalities into a single platform. The system successfully improved response efficiency and reduced redundant efforts by different agencies.

In the Philippine context, Lacasandile and Labanan (2020) examined existing disaster response frameworks and identified key gaps in coordination and real-time data sharing. Their study emphasizes the need for a more unified approach to disaster response, highlighting the potential benefits of an Integrated Disaster Response Information System (IDRIS) similar to those implemented in other countries. Based on the literature and studies reviewed, the development of IDRIS aligns with global best practices in disaster response. The integration of volunteer management, donation tracking, damage assessment, and logistics coordination into a single platform addresses the inefficiencies identified in existing disaster response mechanisms. Furthermore, leveraging real-time data analytics and GIS can enhance resource allocation and decision-making processes, ensuring timely and well-coordinated disaster relief efforts. By incorporating these findings into the design and implementation of IDRIS, the system aims to improve the overall disaster response framework in the Philippines. The use of mobile and web-based platforms ensures accessibility for responders and stakeholders, while real-time communication features address the longstanding issue of coordination failures. Ultimately, IDRIS presents a promising solution to the challenges of disaster response, aligning with international standards for efficiency, transparency, and data-driven decision-making.

Review of Related Systems

This section explores existing technologies, applications, and methodologies relevant to the development of this project. This section aims to analyze and compare similar systems, identifying their strengths, limitations, and unique features.

Features	Barangay Resident Information System and Services (BRISS)	Web-Based Online Donation System	Esri's Emergency Management Operations Solution (EMOS)	IDRIS (Integrated Disaster Response Information System)
Geolocation Mapping	✓	✗	✓	✓
Volunteer Management	✗	✗	✗	✓
Donation Management	✗	✓	✗	✓
Procurement & Supply Chain Tracking	✗	✗	✗	✓
Evacuation & Shelter Management	✗	✗	✓	✓
Financial & Fund Tracking	✗	✓	✗	✓
Report Generation	✗	✗	✓	✓
Situation Reporting & Visualization	✓	✓	✓	✓
Mobile Accessibility	✗	✗	✗	✓

***Legend**:* ✓ - Applicable / Feature is Present

✗ - Not Applicable / Feature is not Present

Table 1. Comparative Matrix of Related Systems based on IDRIS Core Features

The Integrated Disaster Response Information System (IDRIS) was assessed alongside three other relevant systems to highlight its comprehensive functionality across core disaster management features. These systems include the Barangay Resident Information System and Services (BRISS), the Web-Based Online Donation System, and Esri's Emergency Management Operations Solution (EMOS). Each system was evaluated according to ten core features derived from the IDRIS project scope.

BRISS offers basic geolocation mapping, primarily limited to resident profiling at the barangay level, which supports demographic tracking but lacks integration with hazard data, logistics, and shelter information. It does not support volunteer coordination, donation processing, or financial and procurement tracking. This system is best suited for population monitoring but does not extend to broader disaster preparedness and response functionalities.

The Web-Based Online Donation System, on the other hand, excels in donation management and financial tracking, allowing users to donate and access simple donor dashboards. However, it lacks modules for inventory, shelter, geolocation, and real-time updates. As a focused donation platform, it meets the transactional needs of resource gathering but cannot coordinate operational logistics or volunteer engagement, limiting its role in end-to-end disaster response efforts.

Esri's EMOS is a robust geospatial system that excels in situation reporting and visualization, offering dynamic mapping tools to identify affected areas and responder activities. It includes strong support for hazard alerts and spatial overlays, but it lacks components for volunteer, donation, and procurement management. Although it enables high-level monitoring, it is not designed for on-the-ground coordination or automated decision support.

In contrast, IDRIS integrates all ten core features, including interactive geolocation mapping, automated procurement and financial workflows, volunteer and donation dashboards, and real-time communication tools. Its ability to unify stakeholder interactions—spanning LGUs, donors, logistics teams, and shelter coordinators—makes it a holistic disaster management platform. The inclusion of mobile accessibility further ensures that the system remains usable in remote or resource-limited settings, enhancing its effectiveness in the field.

Overall, the leverage of IDRIS on this page reflects its broader application and versatility in managing a range of organizational functions, making it a more comprehensive choice for those who are looking to centralize various operations into one system. Its ability to integrate both administrative and safety systems with financial oversight provides a significant advantage over the other systems, which seem more specialized in their scope.

Conceptual Framework

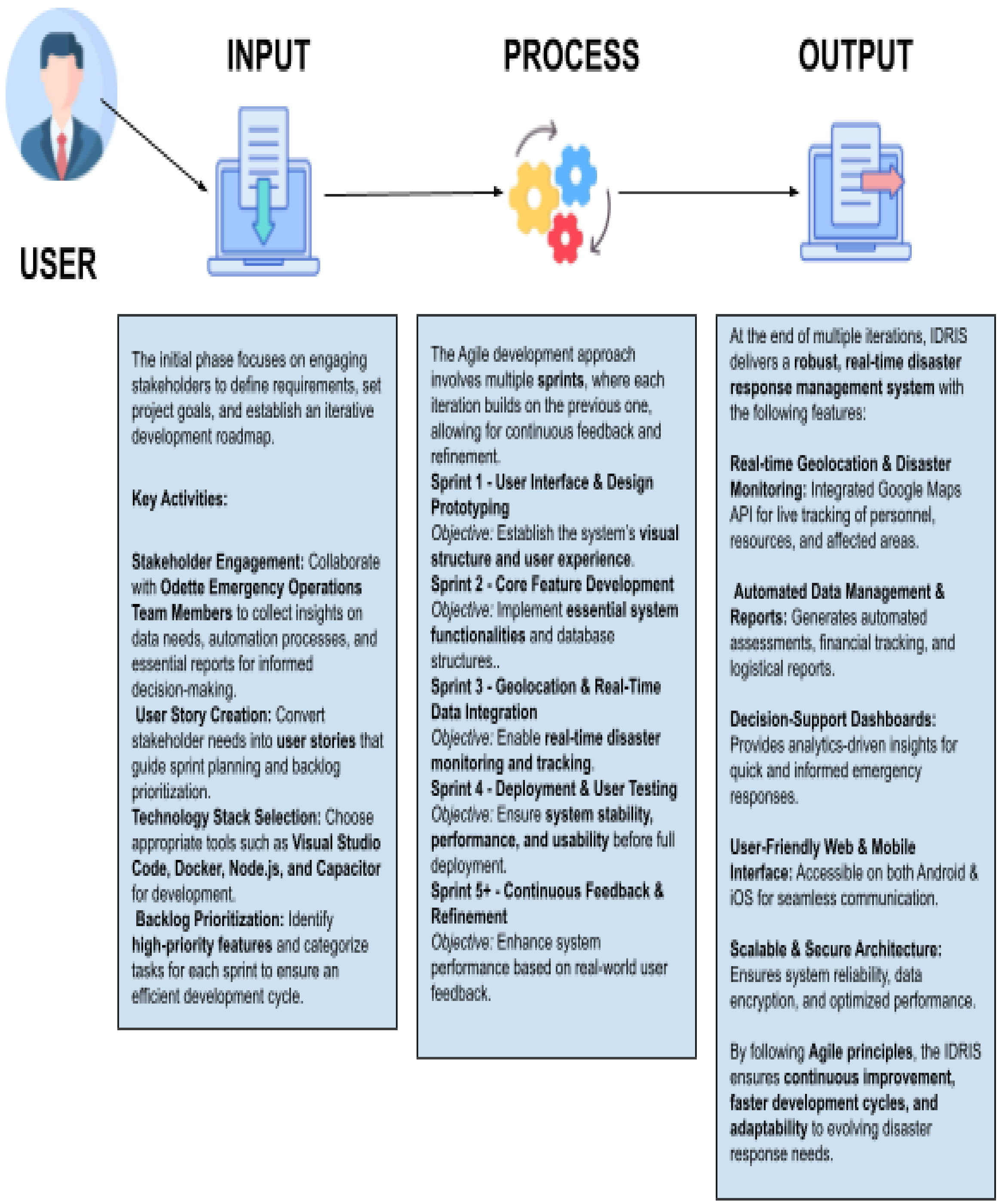

Figure 1. IPO Model

Discussion of IPO

Input: Requirement Gathering & Sprint Planning

The development of IDRIS begins with gathering essential requirements through collaboration with the Odette Emergency Operations Team Members. This phase focuses on understanding the data needs, automation requirements, and reporting functionalities necessary for efficient disaster response management. The team identifies critical processes that should be automated, ensuring that reports are readily available when needed. Additionally, user stories are created to outline specific functionalities from an end-user perspective, guiding the development process. The technology stack is also determined at this stage, selecting tools such as Visual Studio Code, Docker, Node.js, and Capacitor to support both web and mobile application development. The product backlog is then prioritized to plan and allocate tasks for each sprint, ensuring an efficient Agile workflow.

Process: Iterative Development & Continuous Improvement

The Agile-based development cycle of IDRIS is structured into multiple sprints, each focusing on a key aspect of the system. These iterative cycles allow for continuous testing, feedback, and enhancements to improve functionality. Sprint 1 centers on User Interface & Design Prototyping, where the initial design of the user interface (UI) and user experience (UX) is developed to ensure an intuitive and accessible platform. Wireframes and mockups are created for both web and mobile applications, followed by early user testing and stakeholder engagement. Feedback from emergency responders and decision-makers helps refine the UI, ensuring that the system effectively meets practical needs in disaster scenarios.

Moving to Sprint 2, the focus shifts to Core Feature Development, where the foundational features of the system are built. This includes the implementation of automated data processing, user authentication, and dashboard functionalities. The database architecture is also developed to support resource tracking, emergency alerts, and report generation, while the system's backend services and APIs are designed to facilitate real-time data exchange between users and the platform.

In Sprint 3, Geolocation & Real-Time Data Integration is introduced to enhance disaster response coordination. The integration of Google Maps API enables real-time location tracking of emergency personnel, resources, and affected areas. Additionally, geofencing capabilities monitor the movement of responders, while disaster visualization tools provide a clear overview of crisis situations. To ensure smooth system performance, optimizations are carried out to enable fast data retrieval and seamless interaction between users and the system.

As the project progresses to Sprint 4, the system undergoes Deployment & User Testing in a controlled environment. Comprehensive usability, functionality, and maintainability evaluations are conducted based on ISO 9126 standards. Key aspects such as response speed, accuracy, and user-friendliness are assessed, and any identified issues are resolved before full-scale deployment. To enhance security, data encryption and access control mechanisms are implemented to safeguard sensitive information.

Finally, in Sprint 5 and beyond, Continuous Feedback & Refinement ensures that the system evolves based on real-world usage. Feedback from emergency responders and decision-makers provides valuable insights into system performance, usability challenges, and feature requests. This input is used for iterative improvements, allowing the system to remain adaptive to changing disaster response needs. Additionally, regular sprint retrospectives are conducted to refine development processes, optimize workflow efficiency, and ensure continuous enhancement of the system's capabilities.

Output: A Functional, Scalable, and User-Validated Disaster Response System

The final outcome of IDRIS development is a fully functional, scalable, and user-friendly disaster response system. It provides real-time geolocation tracking, allowing authorities to monitor personnel, resources, and affected areas efficiently. Automated data management ensures that critical reports and assessments are generated instantly, reducing manual workload during crisis situations. Decision-support dashboards offer analytics-driven insights, enabling faster and more informed decision-making. The system is designed for web and mobile accessibility, making it available to users on multiple platforms. With its continuous improvement model, IDRIS remains adaptable to new disaster response challenges, ensuring long-term efficiency, reliability, and security in emergency management.

By following Agile methodology, IDRIS fosters rapid iteration, continuous feedback integration, and adaptive planning, ultimately delivering a robust and responsive disaster management solution.

Significance of the Study

The development of the Integrated Disaster Response Information System (IDRIS) by the Ramon Aboitiz Foundation Inc. (RAFI) is highly significant in addressing the critical inefficiencies in disaster response and management, particularly in the Philippines. Given the country's vulnerability to natural disasters such as typhoons, earthquakes, and floods, the need for a centralized, technology-driven disaster response system is paramount. This study aims to enhance disaster preparedness, response, and recovery by integrating real-time data sharing, resource allocation, and volunteer and donation management into a unified platform.

This research primarily benefits **local government units (LGUs)**, which play a crucial role in disaster response and management. Through the IDRIS platform, LGUs will gain access to real-time data on affected areas, casualties, and resource availability, allowing them to make informed decisions quickly. The system enhances coordination between municipalities, provinces, and national disaster response agencies, preventing duplication of efforts and ensuring equitable resource distribution. Furthermore, it improves disaster preparedness strategies by integrating predictive analytics and early warning systems.

Non-governmental organizations (NGOs) and humanitarian agencies also stand to benefit from this study. These organizations are essential in providing relief and rehabilitation services during and after disasters, and the IDRIS system will centralize information on disaster-affected areas to ensure a well-coordinated response. By streamlining volunteer and donation management, the system reduces inefficiencies in logistics and distribution, ensuring aid reaches those in need more effectively. Additionally, IDRIS enhances accountability and transparency in disaster response efforts, promoting trust and reliability among stakeholders.

For **emergency responders and rescue teams**, IDRIS will significantly improve operational efficiency by providing real-time updates on emergency situations, allowing for faster deployment of rescue teams. The system will utilize geospatial data to map out affected areas, enabling more strategic search and rescue operations. By optimizing resource allocation, such as medical supplies, food, and temporary shelters, it ensures that emergency responders can deliver assistance where it is needed most.

Policymakers and disaster management agencies will also find this study valuable, as it provides data-driven insights to support the development of policies and legislation aimed at improving disaster preparedness and response. The system will allow policymakers to evaluate the effectiveness of disaster relief programs and make necessary adjustments for future improvements. Additionally, by establishing a standardized approach to disaster response, IDRIS ensures that best practices and digital solutions are integrated into national and local disaster management frameworks.

The most direct beneficiaries of this study are **communities affected by natural disasters**. Through the implementation of IDRIS, disaster-affected populations can receive aid faster due to improved coordination among government agencies and relief organizations. The system will also empower communities by enabling them to report their needs and emergencies in real-time, ensuring that assistance is provided promptly. Ultimately, by reducing inefficiencies in disaster response, IDRIS helps minimize human suffering and economic losses.

From an academic perspective, this study contributes significantly to the field of **disaster risk reduction (DRR) and digital disaster management**. By addressing existing gaps in research on technology-based solutions for disaster response, IDRIS serves as a model for future studies exploring the integration of digital systems in crisis management. Researchers and academic institutions can utilize this study as a case reference for developing smarter and more responsive disaster management technologies.

Lastly, **Ramon Aboitiz Foundation Inc. (RAFI) and its partner organizations** benefit from this study by strengthening their disaster response capabilities through data-driven decision-making. The implementation of IDRIS enhances collaboration with LGUs, NGOs, and other stakeholders, creating a more unified and efficient disaster response framework. Moreover, by establishing IDRIS as a scalable and adaptable model, RAFI can expand its application to other disaster-prone regions, furthering its mission of promoting resilience and sustainability in disaster management.

Overall, the development of IDRIS represents an innovative and technology-driven approach to disaster response, ensuring faster, more efficient, and well-coordinated relief operations. By integrating digital solutions into disaster management, this study promotes resilience, sustainability, and improved disaster preparedness for vulnerable communities. Furthermore, it contributes valuable insights to academic research and policy development, reinforcing the importance of technology in humanitarian efforts.

Scope and Limitations

The Integrated Disaster Response Information System (IDRIS) is designed to enhance disaster response by integrating key functions such as volunteer management, donation tracking, resource allocation, damage assessment, and logistics coordination. The study focuses on the development, implementation, and evaluation of IDRIS as a digital disaster response platform for the Ramon Aboitiz Foundation Inc. (RAFI) and other disaster response organizations. It aims to improve coordination among local government units (LGUs), non-governmental organizations (NGOs), volunteers, and donors by providing real-time data for decision-making. The system will be available on both web and mobile platforms to ensure accessibility for disaster response teams in various locations.

However, the study has several limitations. First, while IDRIS aims to enhance disaster response efforts, its effectiveness depends on internet connectivity, which may be limited in remote or disaster-affected areas. Second, data accuracy and reliability are constrained by the quality of information inputted by users, as human error and inconsistent reporting could impact system outputs. Third, the system does not replace existing emergency response protocols but rather enhances coordination—it still relies on external agencies for disaster relief execution. Fourth, the study is limited to the Philippine context, particularly in areas where RAFI operates, meaning its findings may not be fully generalizable to other countries with different disaster response infrastructures. Lastly, potential challenges in system adoption may arise due to resistance to change, lack of digital literacy among some responders, and the need for adequate training. Despite these limitations, IDRIS aims to provide a scalable and efficient solution to streamline disaster response operations and improve resource allocation.

Research Methodology

This chapter outlines the research methodology that will be employed in the development and evaluation of the proposed system. The research will adopt the Agile Software Development Life Cycle (SDLC) as the primary development model due to its flexibility, collaborative nature, and iterative process. Agile methodology is particularly beneficial in projects that require continuous feedback and adaptation, which is essential for creating a system that responds effectively to real-time data and user needs. The Agile approach will allow the researchers to develop the system incrementally while responding to feedback from users and stakeholders at the end of each sprint. The methodology will consist of five sprints, each with specific objectives that will contribute to the overall functionality, usability, and reliability of the system. To evaluate the system's progress and ensure its alignment with user expectations, quantitative data collection methods will be employed throughout the development process.

The decision to utilize Agile methodology stems from its focus on iterative development and its ability to accommodate changes in user needs and technical requirements. Unlike traditional development models, which follow a strict and linear path, Agile allows the research team to develop and test the system in short, manageable cycles. The combination of Agile development and quantitative evaluation ensures that IDRIS will be both adaptable to changing conditions and grounded in measurable results. This approach enables the research team to iteratively improve the system while maintaining alignment with practical needs and stakeholder expectations.

Agile Development Approach

The Agile development approach is chosen for its emphasis on iterative progress, collaboration, and adaptability to change. Each sprint in the Agile cycle is designed to focus on delivering specific deliverables, enabling the team to refine and improve the system progressively. By using this approach, the researchers will maintain constant communication with stakeholders, including the RAFI IT team and the Odette Emergency Operations Team, to ensure that their feedback is integrated into the system’s development. The iterative nature of Agile will also help the team address potential technical issues early on and make continuous improvements to the system's features and performance.

The development process will consist of five distinct sprints, each aimed at addressing different aspects of the system. These sprints will cover the initial design phase, core feature development, geolocation and real-time data integration, deployment and user testing, and finally, continuous feedback and system refinement. Through this approach, the system will not only be technically robust but also highly usable, ensuring it meets the practical needs of the users.

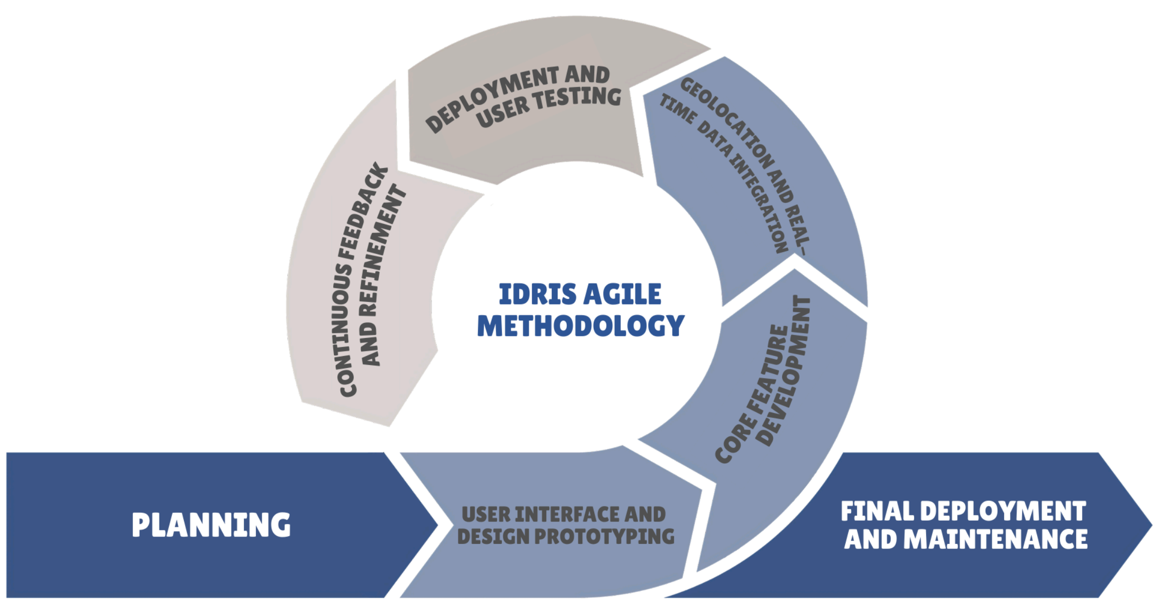

Figure 2. IDRIS Development Methodology

Sprint I: User Interface and Design Prototyping

The first sprint of the project will focus on establishing the user interface (UI) and user experience (UX) design of the disaster monitoring system. This stage will involve creating wireframes and mockups that will represent the system’s visual components, such as the layout, navigation flow, and key elements like buttons, icons, and alert maps. Tools such as Figma will be used to design these components, ensuring that the system will be visually appealing and intuitive for the end-users.

The initial wireframes and prototypes will be reviewed by key stakeholders, including IT faculty members, the RAFI IT team, and members of the Odette Emergency Operations Team. These stakeholders will act as evaluators, providing critical feedback on the usability, consistency, and accessibility of the design. Their input will be used to refine and adjust the UI/UX to ensure that it meets the specific needs of users, especially in emergency situations where quick access to critical information is vital.

The feedback collected during this phase will help identify any potential issues with the design, such as confusing navigation flows or lack of accessibility features. Based on this feedback, the prototypes will be revised and improved, ensuring that the final design is user-friendly and easy to navigate. This iterative process of feedback and refinement will establish a solid foundation for the system’s overall usability.

By the end of this sprint, the research team will have a finalized, high-fidelity UI/UX prototype that will guide the development of the actual system in the following sprints.

Sprint II: Core Feature Development

The second sprint will focus on developing the system's core features, which are essential for the system's basic functionality. During this sprint, the development team will work on implementing user registration and login functionality, as well as developing the backend for managing tasks or alerts. These core features are the foundation for all other functionalities that will be added later, and ensuring they work reliably is crucial to the system's success.

The backend infrastructure will be set up using technologies such as Firebase, PHP, or JavaScript. A well-structured database will be designed to handle dynamic data inputs, such as user information, disaster reports, and geolocation data. This database will be integral in storing and retrieving critical data for the system to function effectively.

In parallel, the system's core functionalities will be developed, including the user registration process and the alert management system. These components will enable users to register for the system, log in securely, and receive disaster-related alerts in real-time. The alert management system will categorize notifications based on the type of disaster, severity, and location, allowing users to prioritize critical information.

Once the core features have been developed, the team will conduct integration and unit testing to ensure that the system works seamlessly. The integration testing will ensure that the different components—such as the registration system, alert management, and database—function properly together, while unit testing will verify that each individual feature works as expected.

By the end of this sprint, the system will have its core features in place, including user registration and login functionality, the backend infrastructure, and the alert management system.

Sprint III: Geolocation and Real-Time Data Integration

The third sprint will focus on integrating geolocation services and real-time disaster data monitoring into the system. This will involve connecting the system to third-party APIs that provide live data on disasters, such as earthquakes, floods, and storms. The system will be able to detect the user's location through geolocation features and provide localized disaster alerts based on the user's position.

The integration of real-time data will allow the system to provide up-to-date information about ongoing disaster events, such as earthquake tremors, flood zones, and storm paths. The system will display this information on an interactive map, allowing users to visualize disaster events in real-time. This feature will be essential for users to stay informed and make timely decisions during emergencies.

To ensure accuracy, the geolocation feature will be thoroughly tested by simulating different user locations and verifying that the system correctly identifies the user's position. This will ensure that users receive alerts relevant to their geographical location. By the end of this sprint, the system will be able to display real-time disaster data on an interactive map, providing users with immediate situational awareness.

Sprint IV: Deployment and User Testing

The fourth sprint will involve deploying the system in a controlled test environment for user testing. The system will be tested by a select group of respondents, including faculty members, the RAFI IT team, and members of the

Odette Emergency Operations Team. These participants will perform predefined tasks, such as registering for the system, receiving disaster alerts, and viewing real-time disaster data.

The feedback from these users will be crucial in evaluating the system's usability, performance, and functionality. The research team will collect data through usability surveys, system usage logs, and direct observation of user interactions. This feedback will help identify any issues or areas for improvement, such as bugs, user interface inconsistencies, or performance bottlenecks.

Based on the feedback, the system will undergo necessary refinements and bug fixes to improve its usability and performance. The goal of this sprint is to ensure that the system is stable, functional, and easy to use, even in a real-world emergency situation.

Sprint V: Continuous Feedback and Refinement

The final sprint will focus on refining the system based on the feedback collected during Sprint IV. This phase will involve making adjustments and improvements to the system to address any issues identified during testing. The team will continue to gather feedback from users through in-app forms, error reporting, and post-use interviews.

This feedback will be analyzed to identify common issues or areas for improvement, and the system will be updated accordingly. New features or enhancements may also be added based on user suggestions and evolving needs. The iterative nature of Agile will allow the development team to continuously improve the system, ensuring that it remains responsive to user needs and adaptable to changing requirements.

By the end of this sprint, the system will have undergone multiple iterations and refinements, making it more robust, user-friendly, and responsive to real-world needs. The final product will be ready for long-term use, providing reliable disaster monitoring and geolocation services to its users.

Respondents of the Study

The study involved a diverse group of stakeholders who are integral to disaster response efforts. Respondents included members from the Odette Emergency Operations Team from RAFI, barangay captains or MDRRMO, information technology staff, and local government officials. These individuals were selected using purposive sampling to ensure that the respondents had the relevant experience and knowledge needed to provide meaningful feedback. Their firsthand experience in disaster response allowed them to offer valuable insights into the system's potential impact, operational requirements, and areas for improvement. By involving these key stakeholders, the study will be able to gather both qualitative and quantitative data to guide the development and refinement of the IDRIS system.

Category	Number of Respondents
Odette Emergency Operations Team Members	10
Barangay Captains / MDRRMO	5
IT Staff / Experts	4
LGU Officials	6
Total Respondents	25

Table 2. Respondents of the Study

This table outlines the estimated number of respondents from different categories involved in the study. The sample size was determined using purposive sampling, selecting individuals directly involved in disaster response operations to provide the most relevant and insightful feedback.

Research Instruments

To evaluate the effectiveness and quality of the Integrated Disaster Response Information System (IDRIS), this study will employ a structured software evaluation checklist based on the ISO/IEC 9126 software quality model. This internationally recognized framework assesses software through six core attributes: functionality, reliability, usability, efficiency, maintainability, and portability (ISO/IEC, 2001). These dimensions are chosen to ensure that the evaluation will focus on both technical soundness and real-world performance, rather than on subjective user opinions.

Given that the research problem and system objectives were clearly defined, there was no need to conduct surveys involving general end-users. Instead, the instrument will focus on evaluating how well the system met established quality standards and operational requirements. Internal and external software quality will be examined from both developmental and deployment standpoints. Internal quality focused on maintainability and performance during development, while external quality covered usability and reliability during actual use. Additionally, the study considered perceived usefulness and ease of use, assessed by internal testers and system developers. These two factors align with key elements of the Technology Acceptance Model, which emphasizes their role in successful system adoption (Davis, 1989).A four-point performance rating scale was used to remove the possibility of neutral or indecisive responses, unlike the common five-point Likert scale. This scale required evaluators to make clear judgments on whether specific criteria were met, supporting a more definitive and measurable evaluation (Joshi, Kale, Chandel, & Pal, 2015).

Rating	Categorical Response	Verbal Description
3.26 - 4.00	Fully Met	The system completely fulfills the requirement.
2.50 - 3.25	Mostly Met	The system fulfills the requirement with minor limitations.
1.75 - 2.50	Partially Met	The system fulfills the requirement only to a small extent.
1.00 - 1.75	Not Met	The system does not fulfill the requirement at all.

Table 3. Performance Rating Scale

Rating	Functionality	Reliability	Usability	Efficiency	Maintainability	Portability
3.26 - 4.00	Very Functional	Very Reliable	Very Usable	Very Efficient	Very Maintainable	Very Portable
2.50 - 3.25	Functional	Reliable	Usable	Efficient	Maintainable	Portable
1.75 - 2.50	Slightly Functional	Slightly Reliable	Slight Usable	Slightly Efficient	Slightly Maintainable	Slightly Portable
1.00 - 1.75	Not Functional	Not Reliable	Not Usable	Not Efficient	Not Maintainable	Not Portable

Table 4. Software Evaluation (Internal and External Quality) Criteria

Rating	Perceived Usefulness	Perceived Ease-of-Use
3.26 - 4.00	Very Useful	Very Easy to Use
2.50 - 3.25	Useful	Easy to Use
1.75 - 2.50	Partially Useful	Not So Easy to Use
1.00 - 1.75	Not Useful	Not Easy to Use

Table 5. Software Evaluation (Perceived Usefulness and Perceived Ease-of-Use) Criteria

Treatment of Data

In this study, the effectiveness and quality of the Integrated Disaster Response Information System (IDRIS) will be evaluated using a structured software evaluation checklist, based on both ISO/IEC 9126 software quality model and the Technology Acceptance Model (TAM). The evaluation will consider internal and external software quality criteria, along with perceived usefulness and perceived ease of use as part of the TAM framework. These factors will be assessed through a 4-Point Performance Rating Scale, where evaluators provided ratings ranging from 1 (Poor) to 4 (Excellent) on each criterion.

The data gathered from the evaluations will be analyzed using three primary statistical methods: weighted mean, frequency, and simple percentage statistics. These methods are selected to provide a comprehensive and quantitative analysis of the system's performance, allowing for clear, actionable insights regarding both technical quality and user perception.

1. Weighted Mean

The weighted mean will be employed to calculate the overall performance of the IDRIS system across the evaluation criteria, where different criteria will be considered to have varying levels of importance.

Each evaluation criterion will be assigned a weight based on its importance. These weights will then be used in the calculation of the weighted mean, ensuring that more important attributes contributed more heavily to the overall evaluation. The weighted mean will provide a balanced summary of the performance of the system, reflecting both the technical and user-centered dimensions of quality.

The formula for the **weighted mean** is:

$$\overline{x} = \frac{\Sigma(x_i \times w_i)}{\Sigma w_i}$$

Where:

- $\overline{x}$ is the weighted mean.
- x_i is the score (rating) for each evaluation criterion.
- w_i is the weight assigned to each criterion.
- Σ represents the summation across all criteria.

By analyzing these statistics, the study will be able to draw comprehensive conclusions about the overall effectiveness, technical quality, and user satisfaction with the IDRIS system. This approach ensured that both the technical attributes of the system and user perceptions were taken into account, providing a balanced assessment of the system's strengths and areas for improvement.

System Methodology

External Interface Requirements

User Interfaces

All interfaces within the IDRIS system will be designed with a consistent and user-friendly layout. To enhance usability and minimize user input errors, the interface utilizes form controls such as checkboxes, radio buttons, and dropdown lists. Data validation will also be implemented using HTML and JavaScript to ensure proper formatting before submission.

The user interface will also be designed with role-based access: volunteers, LGU staff, donors, and admin users each have distinct views and permissions. Real-time feedback messages appear beside form fields to guide users when errors occur, offering helpful suggestions for correction. Additionally, an FAQ and Help section will be available to support users and reduce reliance on system administrators.

The design will be mobile-responsive and compatible with both desktop and mobile browsers, ensuring accessibility for field officers and remote users. Color coding and intuitive layout help users distinguish between different system modules such as Damage Reporting, Procurement, Inventory, and Distribution.

Hardware Interfaces

a. Server Side

The system will be deployed on a cloud-based or institutional Windows/Linux server environment. It will connect to a centralized PostgreSQL database instance. The backend server hosts the FastAPI-based application, running on a secure HTTPS port.

b. Client Side

IDRIS will be a browser-based web application. End-users can access the system via modern browsers such as Google Chrome, Mozilla Firefox, or Microsoft Edge. Devices must have a stable internet connection. Mobile and tablet access is supported, especially for field responders and barangay officials.

Software Interfaces

a. Server Side

- The backend is developed using FastAPI (Python framework).
- Data is stored and managed in a PostgreSQL database.
- Docker is used for containerized deployment, with continuous integration handled through GitHub Actions.

b. Client Side

- The frontend will be developed using ReactJS, ensuring a dynamic and responsive interface.
- Compatible with any operating system that can run HTML5-compliant browsers.
- AJAX and RESTful APIs will also be used for smooth asynchronous data transactions.

Communications Interfaces

IDRIS will use the HTTPS protocol to ensure secure communication between the client and server. All API endpoints will also be authenticated using token-based access. SMS and email notifications are integrated for real-time alerts (e.g., task assignments, disaster updates). APIs also support third-party services such as map layers or government open-data platforms if required.

Functional Requirements

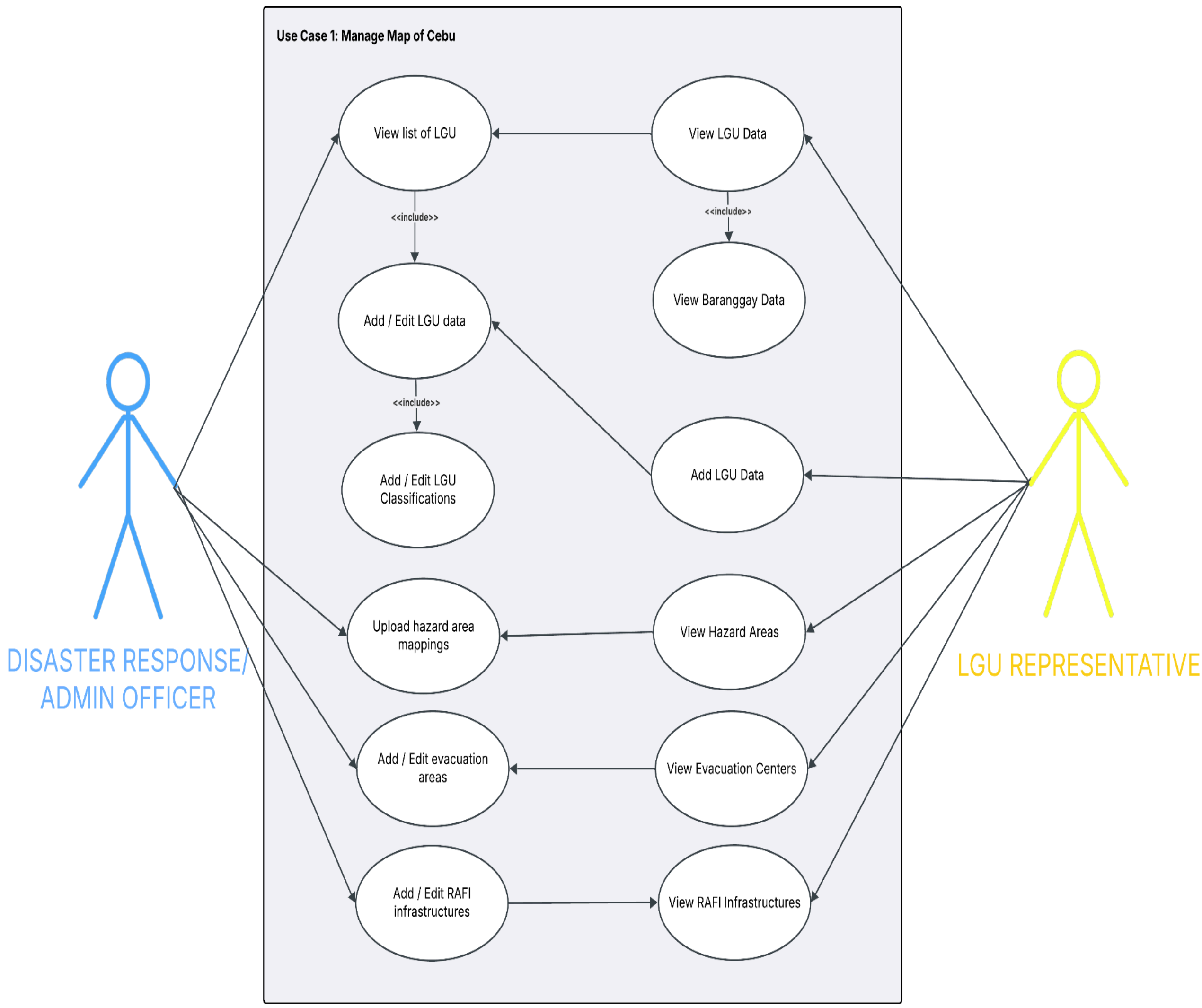

Figure 3. Use Case 1: Manage Map of Cebu

This use case facilitates the collaborative maintenance and enrichment of geospatial data critical for disaster preparedness and mitigation. The Disaster Response Admin Officer is responsible for uploading and managing core location data, such as LGU boundaries, hazard-prone zones, evacuation sites, and RAFI infrastructure. They can also classify LGUs and edit details based on verified updates from field reports. LGU Representatives complement this process by viewing barangay-level information and contributing new LGU data, ensuring that the map remains accurate and contextually relevant.

By enabling both central and local actors to access and update map data, the system promotes coordinated disaster planning. The shared map layer, combined with real-time updates, enhances situational awareness for all stakeholders. This collaboration ensures that the spatial database reflects current field conditions, improves resource targeting, and lays the foundation for geographically informed decision-making during emergencies.

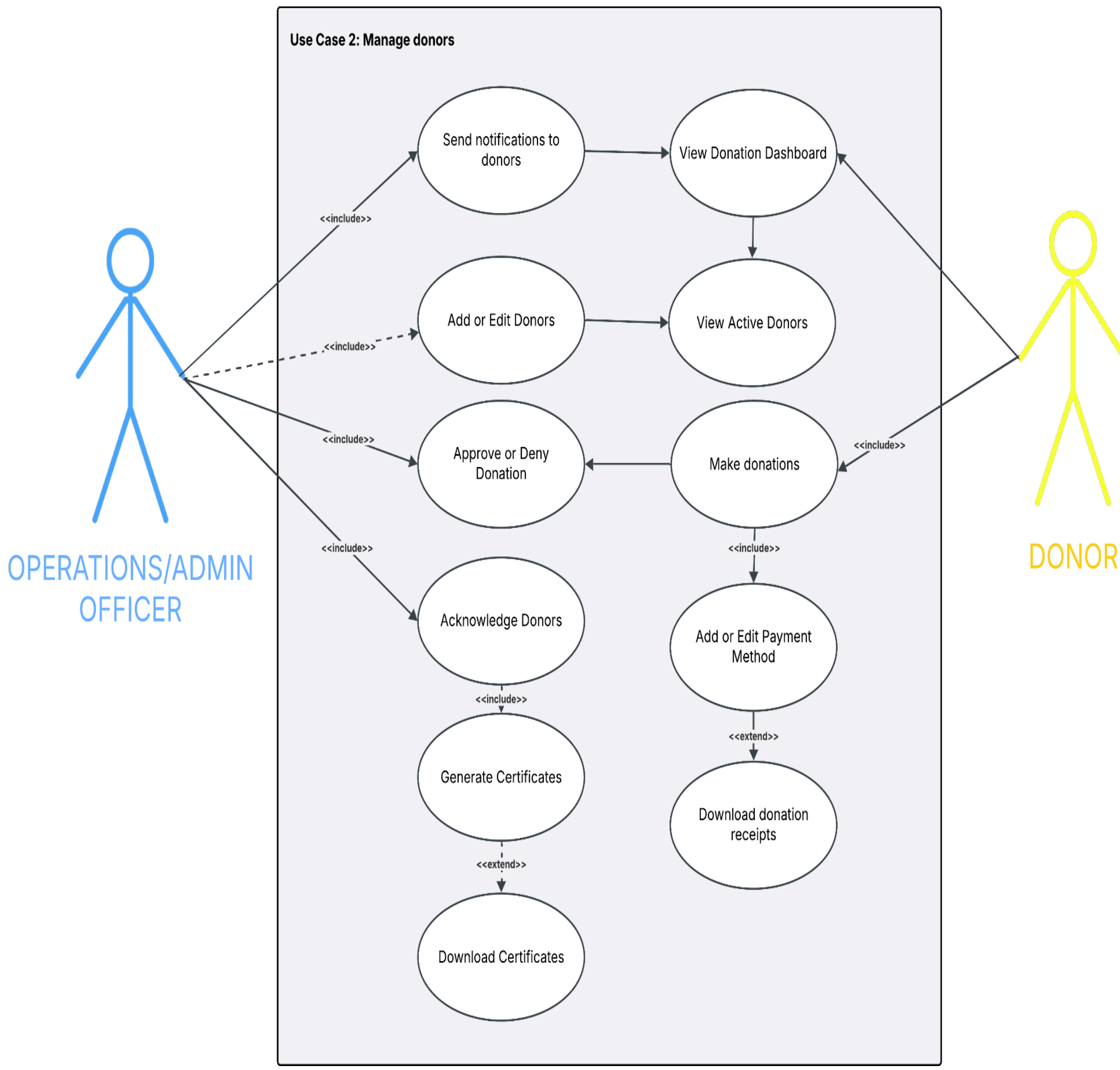

Figure 4. Use Case 2: Manage Donors

This use case focuses on donor management, providing a transparent and efficient interface for tracking and engaging supporters. Operations/Admin Officers handle the administrative functions, such as maintaining donor records, verifying transactions, and approving or rejecting donation entries. The system enables them to send automated acknowledgments and generate donation certificates, promoting donor recognition and retention.

Donors interact with the platform by accessing the donation dashboard, submitting funds, choosing or updating payment methods, and downloading receipts. This interaction not only streamlines donation processing but also fosters accountability through documentation. Overall, this use case strengthens public trust and encourages sustained participation by maintaining a clear and rewarding donation process.

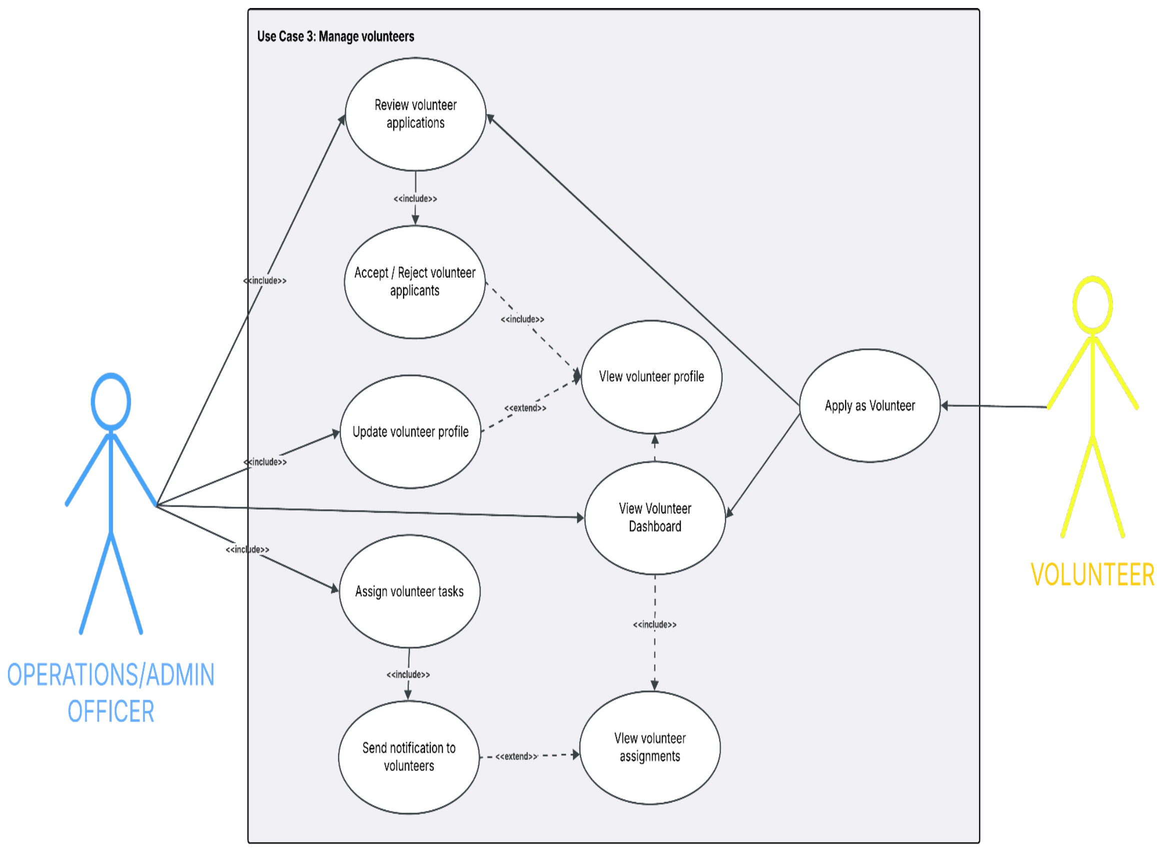

Figure 5. Use Case 3: Manage Volunteers

Volunteer management begins with applications submitted by interested individuals. These are reviewed by the Operations/Admin Officer, who evaluates qualifications, approves or rejects candidates, and updates their volunteer profile in the system. Once accepted, volunteers are assigned tasks, which are reflected in their personal dashboard. Notifications are sent to ensure timely awareness and task fulfillment.

This use case enhances volunteer coordination by centralizing data and enabling role-specific assignments. Volunteers gain visibility into their contributions, while administrators maintain oversight of participation levels and performance. This fosters engagement, ensures accountability, and improves responsiveness in volunteer-driven operations.

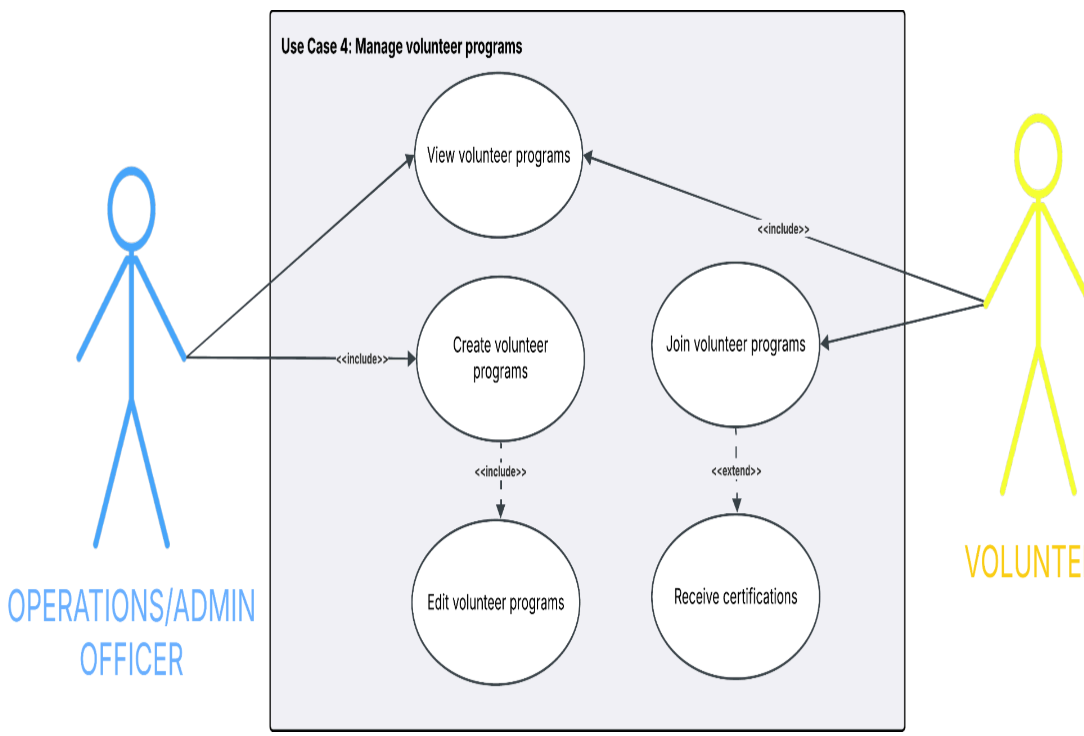

Figure 6. Use Case 4: Manage Volunteer Programs

Through this use case, the Operations/Admin Officer can develop structured volunteer programs aligned with specific operational needs. These programs include objectives, duration, and eligibility, all of which are visible to registered volunteers. Volunteers can browse available programs and enroll, with the system recording their participation history.

After participation, the system allows for the issuance of digital certificates, recognizing volunteers for their involvement. Admins can edit or update program details as needed. This feature promotes structured engagement, enhances volunteer satisfaction, and supports program scalability by ensuring recognition and continuity.

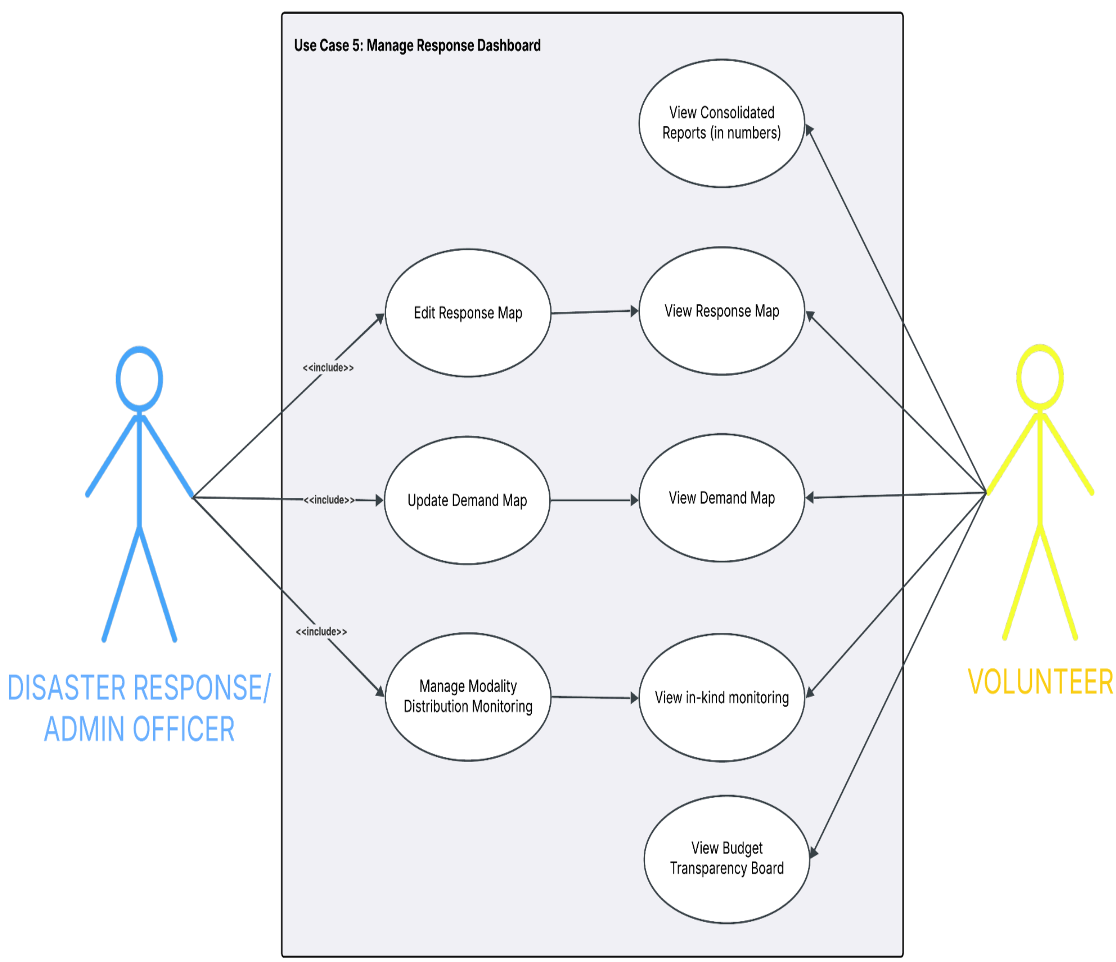

Figure 7. Use Case 5: Manage Response Dashboard

The response dashboard acts as the visual command center of IDRIS, offering a real-time overview of disaster operations. The Disaster Response/Admin Officer updates the dashboard with critical data, including demand maps, response deployment locations, and modality tracking. This data is visualized to support high-level decision-making.

Volunteers and field personnel access the dashboard to monitor the progress of distributions, identify unmet needs, and review financial transparency boards. It also includes consolidated reports in numeric form. The module improves situational awareness, promotes transparency, and enhances collaboration across teams.

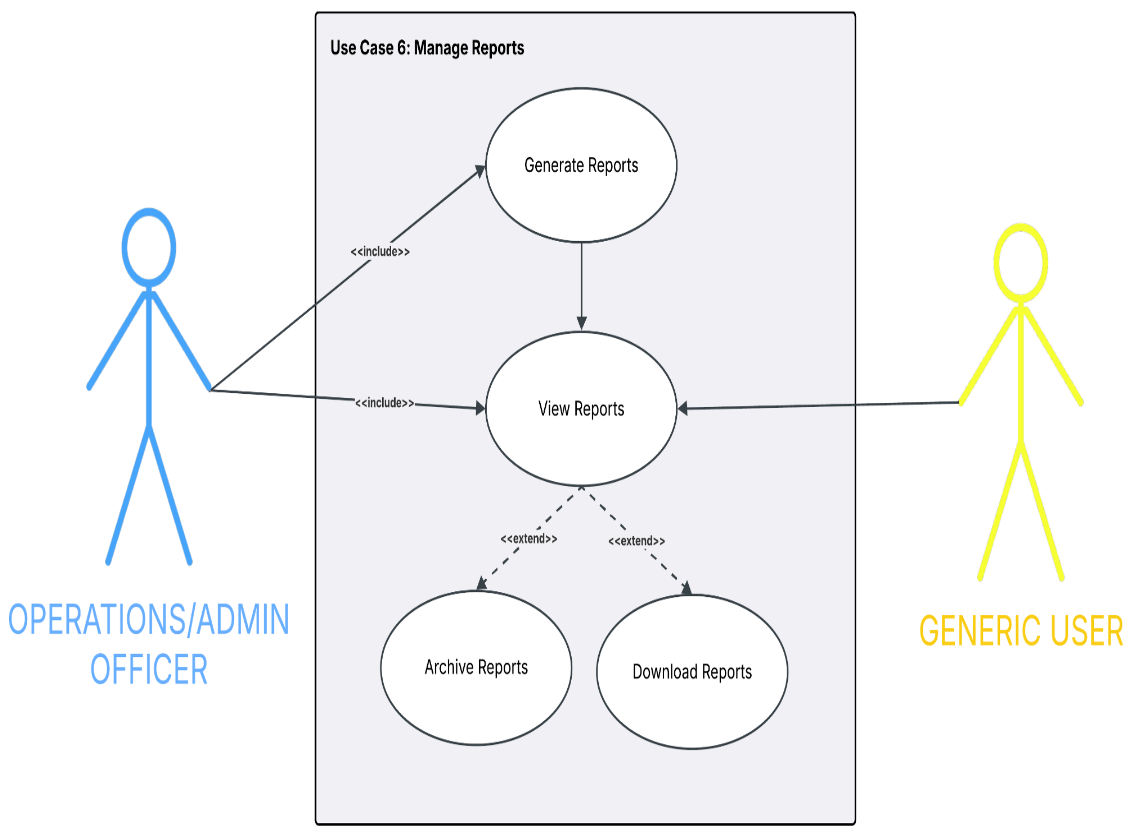

Figure 8. Use Case 6: Manage Reports

Report generation is initiated by the Operations/Admin Officer, who uses the system to compile relevant data into structured formats. Reports are categorized by purpose (inventory, procurement, donations, etc.) and are viewable within the platform. These can be archived for historical analysis or exported for presentation and documentation purposes.

Generic users, such as donors or public stakeholders, are permitted to view and download available reports, which improves information accessibility and accountability. This module supports open data principles and aids in decision-making through consistent documentation of operational outcomes.

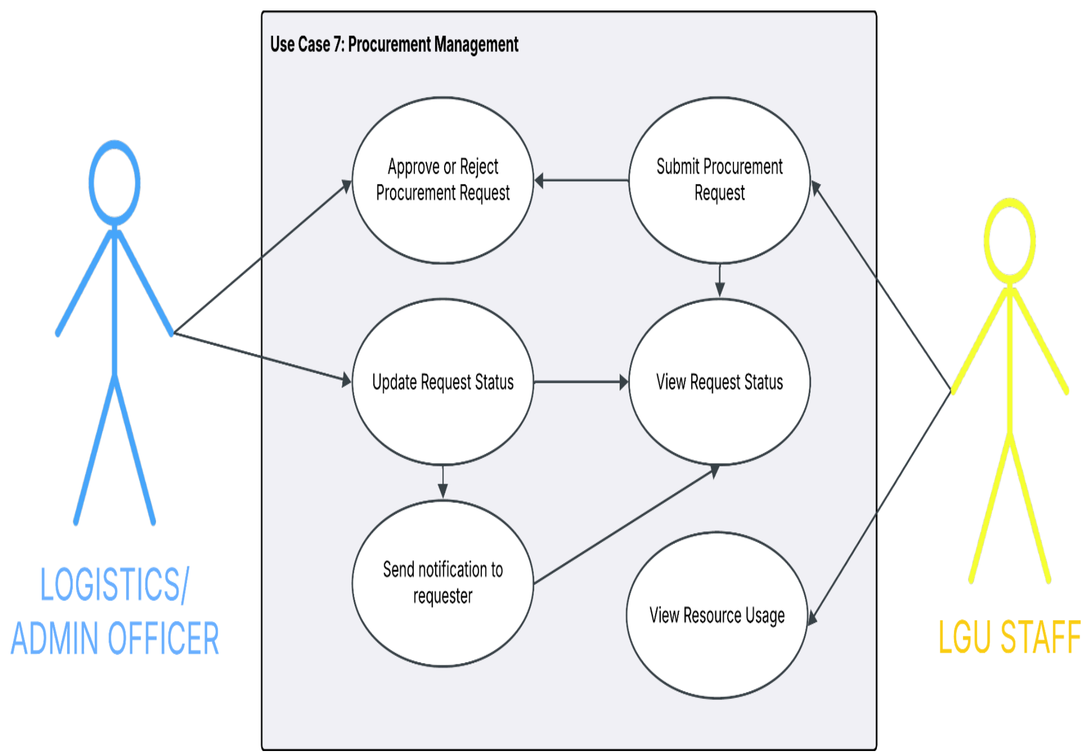

Figure 9. Use Case 7: Procurement Management

This use case governs the supply requisition process. LGU Staff submit procurement requests based on local needs. These requests are then reviewed by the Logistics/Admin Officer, who either approves or rejects them based on available resources and system validation. Approved requests are updated in real time, and users are notified of status changes.

The system also allows both parties to view procurement histories and current resource usage, which informs more strategic planning. This structured request-and-approval cycle minimizes duplication, ensures appropriate distribution, and promotes fair resource allocation.

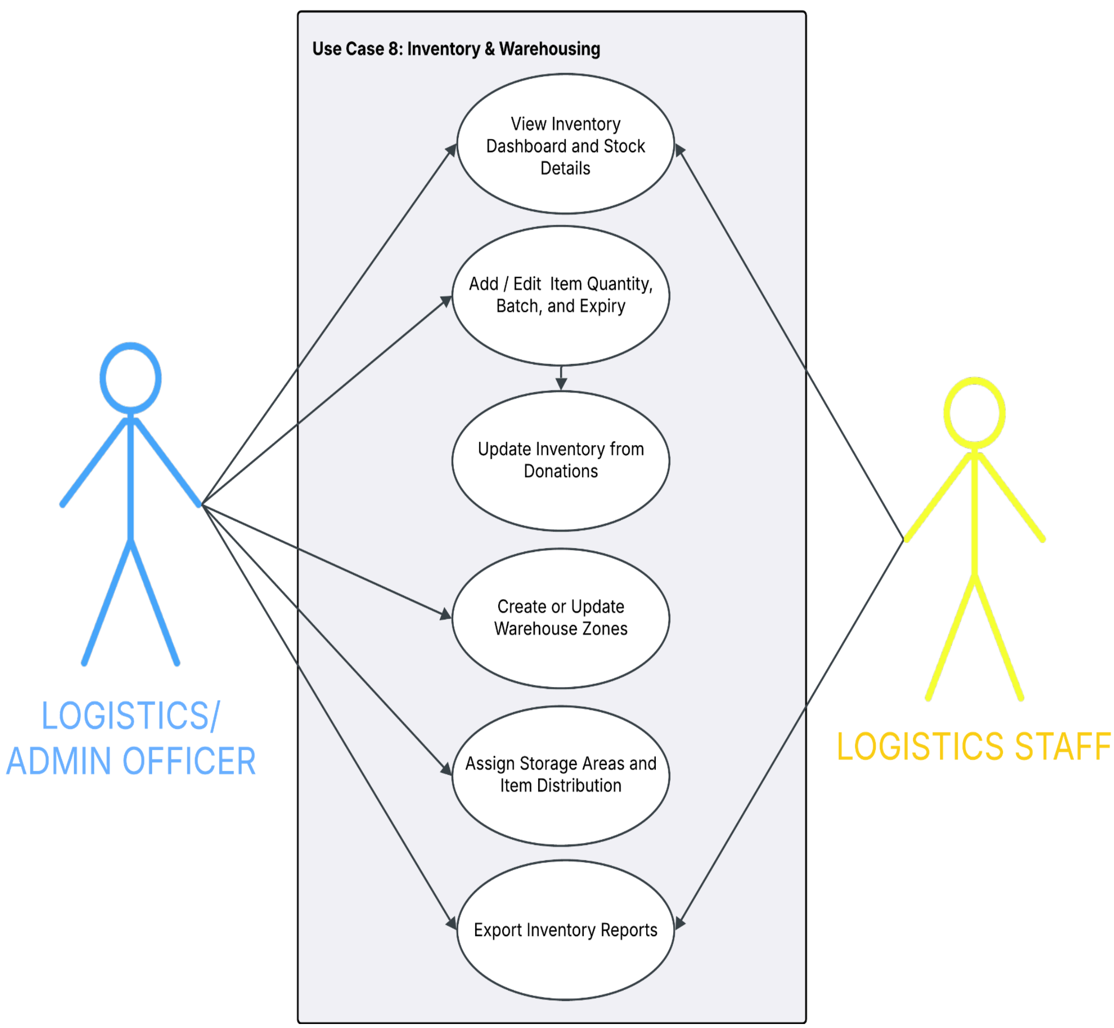

Figure 10. Use Case 8: Inventory and Warehousing

Inventory and warehouse management is jointly handled by the Logistics/Admin Officer and the Logistics Staff. The system allows them to update item quantities, track expiration dates, log donation-based inventory inflows, and categorize stock. They can also create and edit warehouse zones to optimize space usage and accessibility.

Assignments of items to specific storage areas and exportation of inventory reports are also facilitated. These capabilities ensure accurate record-keeping, streamline physical inventory flow, and provide a reliable data trail for audits and supply chain assessments.

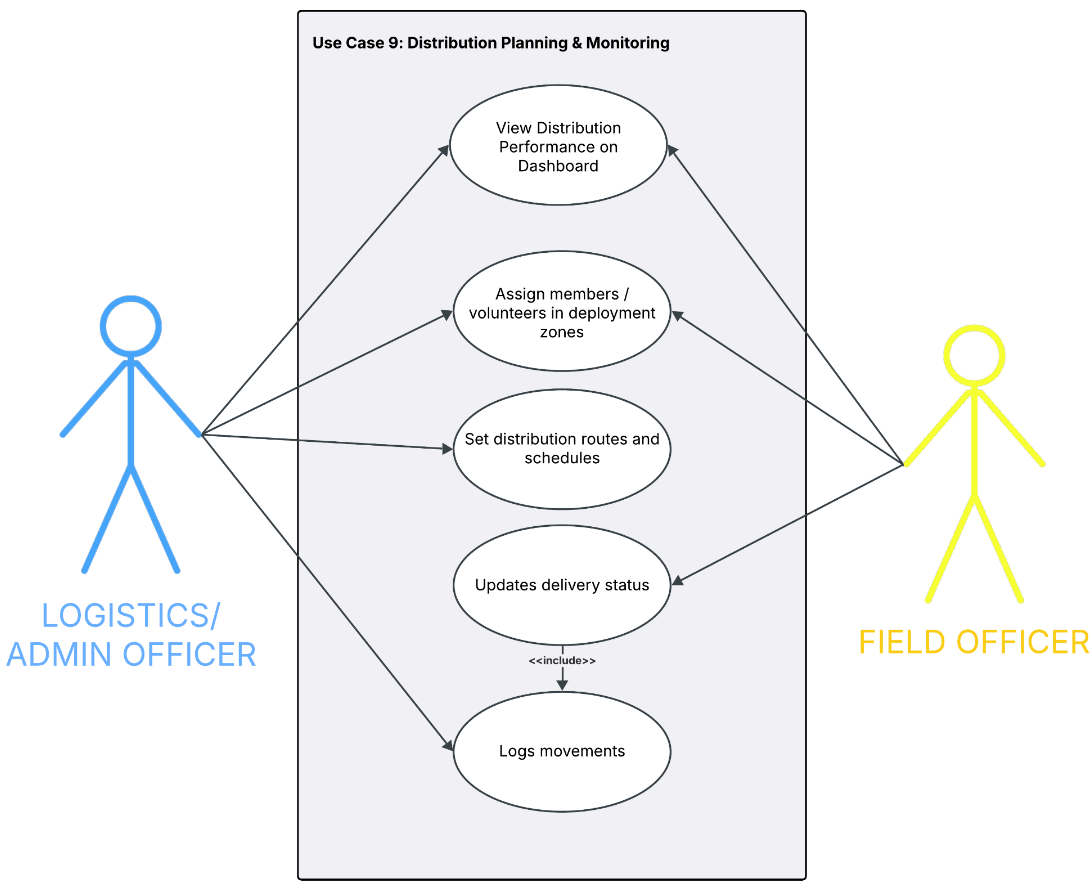

Figure 11. Use Case 9: Distribution Planning & Monitoring

In this module, the Logistics/Admin Officer defines the structure for disaster goods distribution. They assign staff or volunteers to deployment zones and set specific schedules and routes. This structure ensures that all participants know their roles and that deliveries are planned according to need and priority.

Field Officers update the delivery status as activities unfold, and the system automatically logs movement records. Distribution performance is displayed on a dashboard accessible to both roles. This ensures real-time monitoring and allows for adjustments that improve distribution accuracy and timeliness.

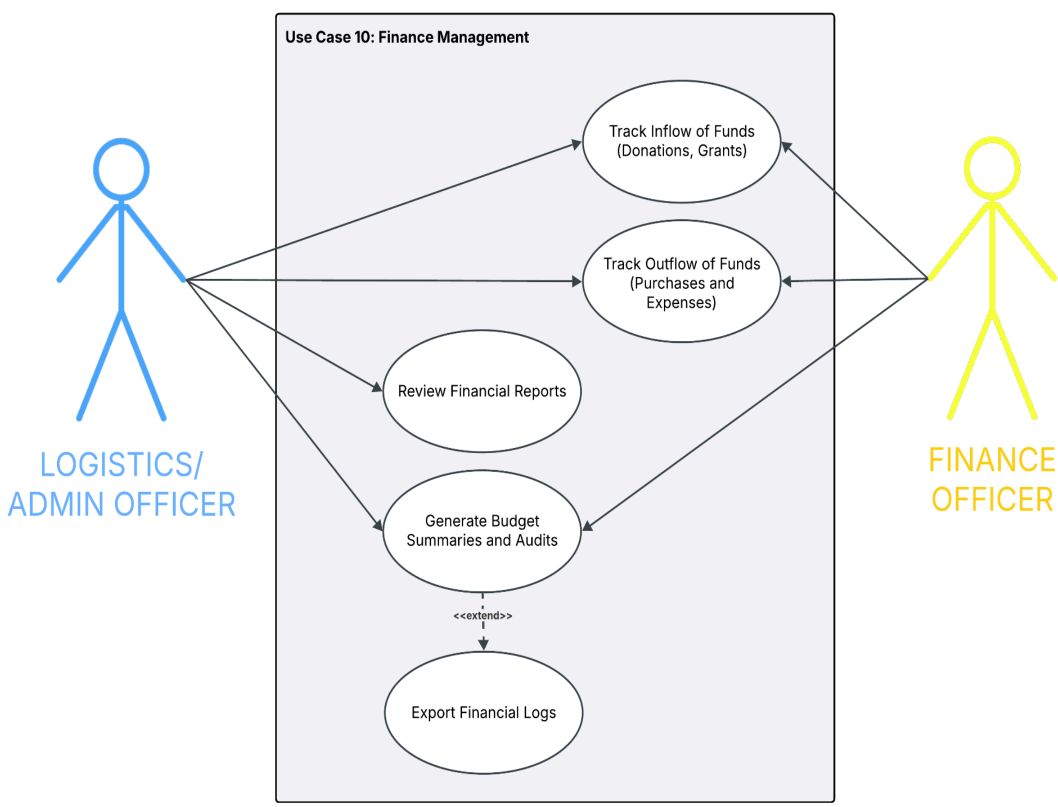

Figure 12. Use Case 10: Financial Management

Financial oversight is managed collaboratively by the Finance Officer and the Logistics/Admin Officer. The system records both the inflow of funds—such as donations and grants—and outflow through procurement and operational expenses. These entries are compiled into comprehensive financial reports.

Administrators can review summaries and generate audits, which may then be exported as financial logs. This module promotes fiscal transparency and builds donor confidence while also supporting compliance with institutional and legal financial regulations.

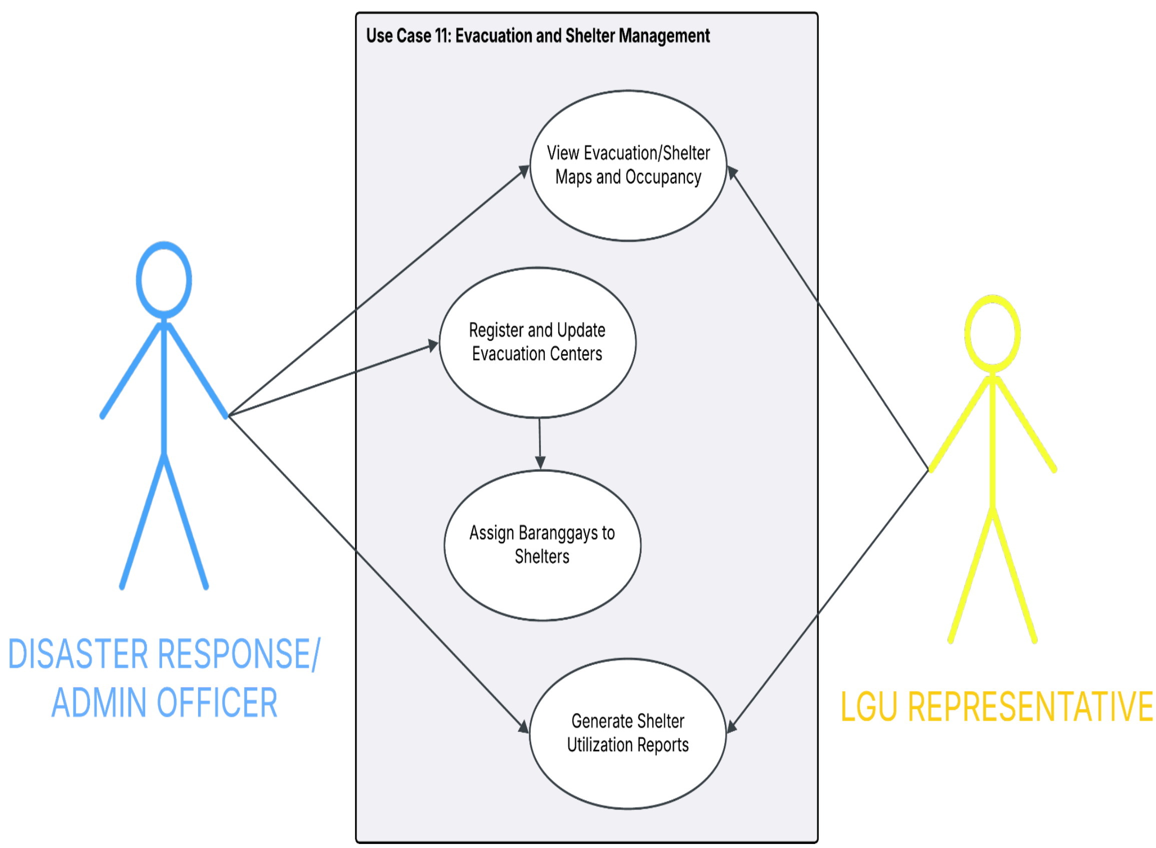

Figure 13. Use Case 11: Evacuation and Shelter Management

This use case supports the planning and coordination of evacuation shelters. Disaster Response/Admin Officers register and update shelter facilities, assigning barangays to shelters based on geographic proximity and capacity. The system also enables the generation of shelter utilization reports.

LGU Representatives participate by viewing maps of evacuation locations and updating information on occupancy levels. This two-way interaction ensures that decisions are made based on current data, enabling faster, more effective responses during disasters.

Performance Requirements

Software:

IDRIS will be designed to support high user concurrency, particularly during disaster events. The system must ensure that 95% of all visible pages for standard users load within 5 seconds or less, including dynamic content such as dashboards, reports, and map layers—excluding heavy backend processes and external API dependencies.

Measurement Points:

Performance will be monitored using tools such as Apache Benchmark, Locust, or Google Lighthouse. These tools will simulate real user loads and measure:

- Frontend response time – time from user request to full page render.
- API response time – time for data transactions between client and server.

- Database query latency – using server logs and query profiler for PostgreSQL.

Backend performance will also be tracked through FastAPI's built-in logging and server response metrics.

Design Constraints

The IDRIS platform will be developed based on the following stack:

- Frontend: ReactJS
- Backend: FastAPI (Python)
- Database: PostgreSQL
- Containerization: Docker
- Deployment: GitHub Actions CI/CD pipelines
- Hosting: Cloud-based VM or institutional server (HTTPS required)

The system must adhere to open-source technologies for scalability, flexibility, and academic compliance.

Software System Attributes

Security

IDRIS will implement multi-layered security mechanisms to protect sensitive disaster response data. These include:

- OAuth-based authentication for secure login sessions
- End-to-end encryption for data in transit
- Role-Based Access Control (RBAC) to enforce data visibility and permissions based on user roles (Admin, LGU Staff, Volunteer, Donor)

- Encrypted and salted password storage in the PostgreSQL database
- Activity logging for critical actions (login attempts, approvals, data changes) to ensure traceability and accountability

Maintainability

IDRIS will be built with modular architecture using FastAPI (backend) and ReactJS (frontend), which simplifies updates and debugging. Key maintainability features include:

- Source code version control via Git
- Continuous integration/deployment through GitHub Actions
- Separation of configuration files for flexible deployment
- Containerization via Docker, ensuring consistent development and production environments

Portability

The system will adapt web-based and designed to run across multiple environments and platforms. Portability is ensured through:

- Cross-platform compatibility with all modern web browsers on Windows, Linux, and macOS
- Docker containerization for easy transfer and deployment across cloud, on-premise, and local environments
- No dependencies on proprietary software, ensuring long-term adaptability

Scalability

IDRIS will support large-scale deployment through its cloud-based architecture. It will be capable of handling real-time data processing and disaster coordination at national or multi-regional levels. Microservices and API-driven design will allow the system to scale horizontally with demand.

Reliability

To ensure high availability during emergencies:

- System redundancy is employed at the database and server levels
- Continuous monitoring tools track uptime and detect failure
- Failover mechanisms help preserve data integrity and system access during peak load

Performance Optimization

System performance will be enhanced through:

- Load balancing to distribute user requests evenly
- Server-side caching for frequently accessed data
- Database indexing to speed up complex queries
- Asynchronous API calls to reduce frontend wait times

Other Requirements

Feasibility Schedule

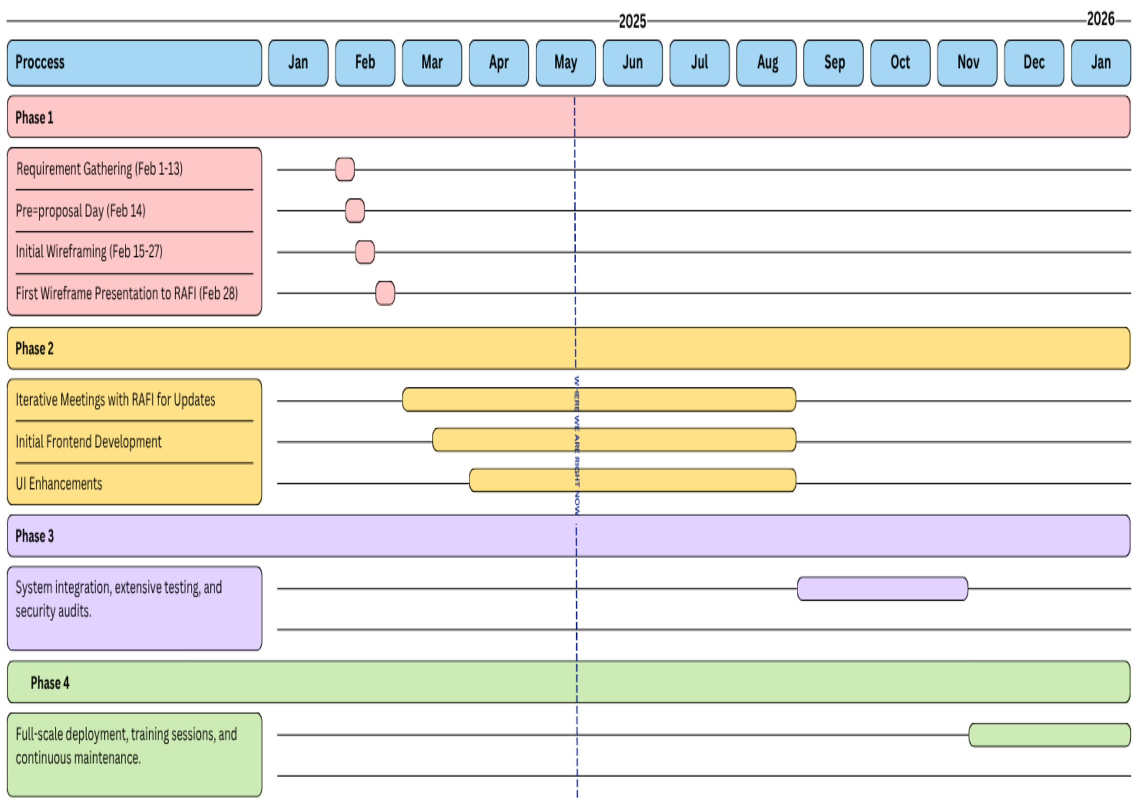

Figure 14. IDRIS Gantt Chart

This figure shows the IDRIS Gantt chart, and outlines the structured timeline of the IDRIS project, divided into four distinct phases spanning from February 2025 to January 2026. Each phase includes specific tasks and milestones, ensuring a systematic approach to project development, testing, and deployment.

Phase 1, covering February to April 2025, focuses on early-stage project activities such as requirement gathering (Feb 1–13), the pre-proposal stage (Feb 14), initial wireframing (Feb 15–27), and the first wireframe presentation to RAFI (Feb 28). This phase establishes the project foundation through collaboration with stakeholders and the creation of initial system prototypes. It continues through April to allow refinement of system design and preparatory work for development.

Phase 2 runs from March to September 2025 and centers on development and iterative improvements. Key activities include continuous iterative meetings with RAFI for alignment and feedback, initial frontend development, and UI enhancements. These tasks overlap and evolve together, enabling a flexible, feedback-driven development cycle. This phase reflects Agile methodology principles, promoting incremental builds and stakeholder involvement throughout the process.

Phase 3, from October to November 2025, is dedicated to system integration, extensive testing, and security audits. This phase ensures that all developed modules are combined, thoroughly evaluated for performance, and verified against security protocols before public exposure.

Phase 4, spanning December 2025 to January 2026 onwards, is the final operational stage. It includes full-scale deployment, training sessions for users and stakeholders, and continuous maintenance. These efforts prepare the system for sustainable, long-term use while supporting users post-launch.

Data Design (Class Diagram)

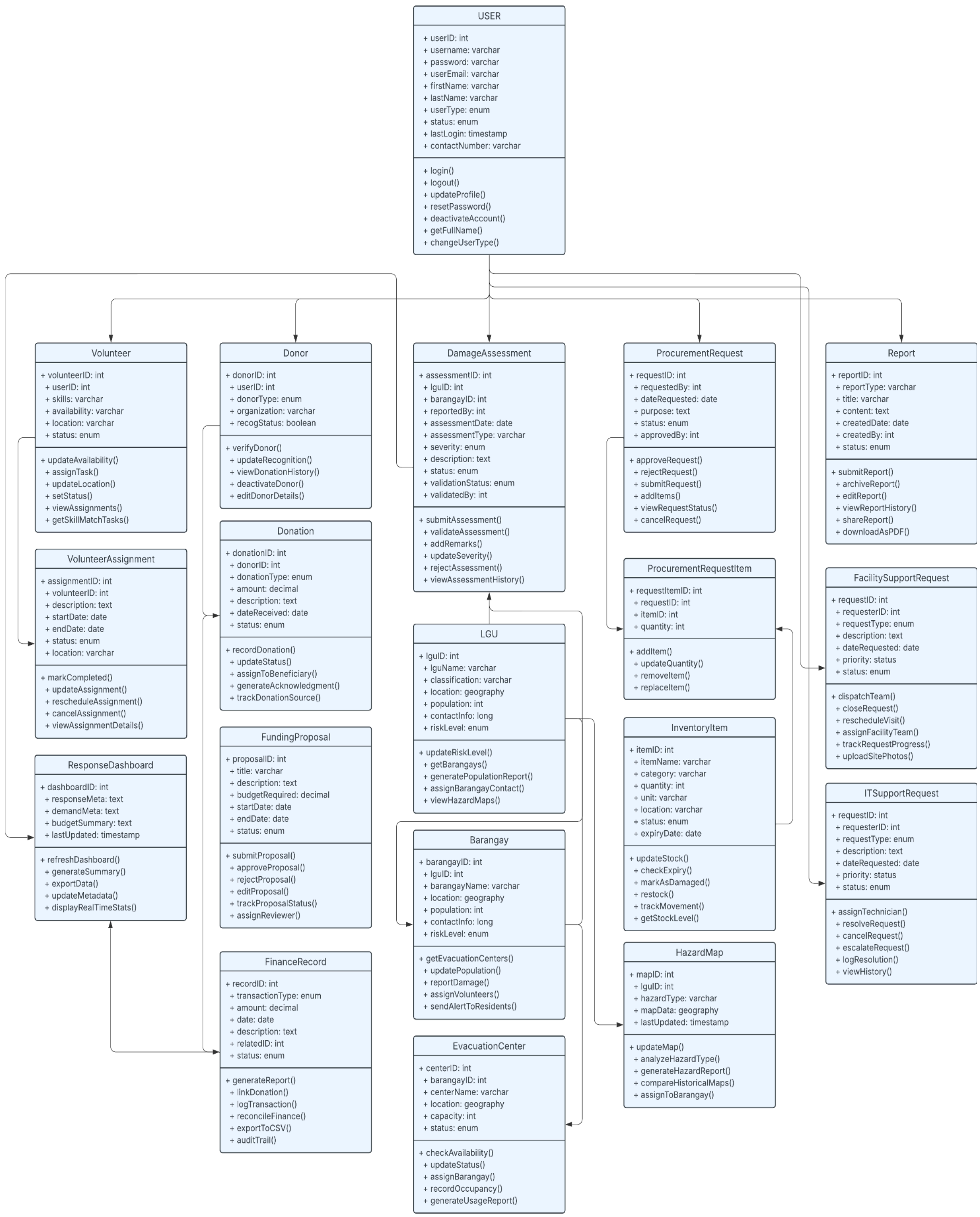

Figure 15. IDRIS Class Diagram

The class diagram for the Integrated Disaster Response Information System (IDRIS) presents a comprehensive view of the system’s architecture, showcasing the core components and their interactions. At the center of the design is the USER class, which acts as the parent entity for various user roles, including volunteers, donors, local government unit (LGU) staff, and support personnel. The system is structured to handle multiple disaster response functions such as volunteer management, donation tracking, damage assessment, procurement requests, and evacuation center coordination. Each component is represented by a class with specific attributes and methods tailored to its function—for example, the VolunteerAssignment class manages task allocation, while the DamageAssessment class records and evaluates the severity of incidents. The LGU and Barangay classes facilitate coordination and risk analysis at the local level. Other modules, such as InventoryItem, FundingProposal, FacilitySupportRequest, and HazardMap, support operational logistics and situational awareness. Through the use of inheritance, associations, and encapsulation, this class diagram illustrates how IDRIS integrates diverse disaster response activities into a unified system, ensuring efficient communication, real-time decision-making, and streamlined resource management during emergencies.

System Architecture

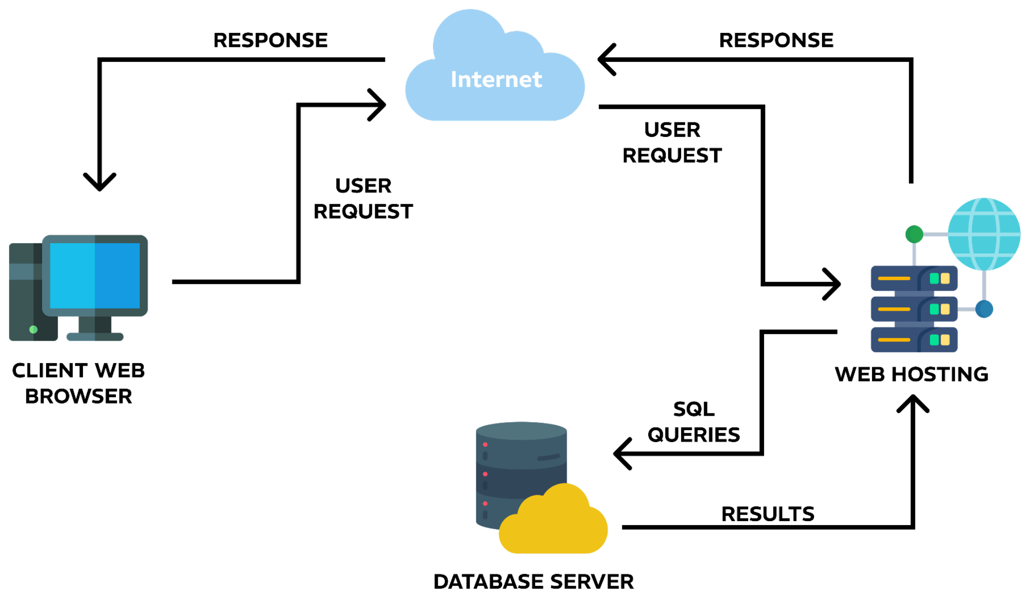

Figure 16. IDRIS System Architecture

The figure provides a clear representation of how the Integrated Disaster Response Information System (IDRIS) facilitates the flow of data between users, web services, and databases. At the core of the architecture is the client web browser, which serves as the user interface through which disaster response personnel, such as administrators, donors, volunteers, or LGU staff, initiate a user request. This request is transmitted over the internet and directed toward the web hosting server, which is responsible for managing and executing the necessary backend logic and routing the request appropriately.

Once the web host receives the user request, it sends SQL queries to the database server, which stores structured disaster response data including donations, logistics details, resource allocation, and user information. The database server processes these queries and returns the appropriate results to the web host. The web host then packages the information and sends it back as a response through the internet to the client web browser, completing the data cycle.

This architecture enables real-time, bidirectional communication that is crucial for disaster response coordination. By centralizing access through a web-hosted application and maintaining structured data interactions with a database server, IDRIS ensures efficiency, transparency, and rapid information delivery. This setup also supports scalability and integration with other disaster management platforms while preserving data security and accuracy during critical operations.

Final Deployment and Maintenance

Once all functional, performance, and security benchmarks are met, IDRIS is prepared for full-scale deployment. The system is hosted on a scalable cloud infrastructure, ensuring high availability and reliability during crisis situations. Real-time data synchronization across web, mobile, and IoT devices guarantees that disaster response teams always have access to the most up-to-date information. Continuous 24/7 system monitoring is implemented through automated logs and anomaly detection tools to proactively prevent downtime.

By integrating a structured Agile methodology, system architecture, technical feasibility, and feasibility schedule, IDRIS remains a scalable, efficient, secure, and user-centered disaster management platform. Its iterative approach ensures continuous adaptation to emerging disaster response needs, reinforcing preparedness and coordination efforts for future crises.

Definition of Terms

This contains all of the terms essentially utilized and defines them accordingly on how it is utilized in this study. These terms are the following:

Damage Assessment - The evaluation and reporting of disaster impacts on households, infrastructure, and communities to inform response priorities and resource allocation within the system.

Dashboard - A user interface within IDRIS that consolidates and visualizes key metrics such as volunteer status, donation flows, resource distribution, and response progress to aid monitoring and decision-making.

Disaster Response - Immediate and coordinated actions to mitigate the impacts of natural or man-made disasters, including rescue, relief, damage assessment, and resource distribution.

Disaster Response Officer - Coordinates and supports the planning and execution of disaster response activities. Monitors ongoing response operations, manages modality distribution, and ensures effective communication and reporting during emergencies.

Donation Management - The process of recording, tracking, and allocating financial and in-kind donations for disaster relief, including dashboards, donor lists, automated receipts, and funding proposals, as managed within IDRIS1.

Donor - Individual or organization that provides cash or in-kind contributions to support disaster response efforts. Can register, track donations, and access receipts and recognition through the donation management module.

Field Officer - Operates at the ground level to collect data, conduct assessments, and implement response activities. Inputs barangay-level data, reports damages, and ensures accurate and timely information flows from the field into IDRIS.

Geolocation Tracking - Use of mapping and GPS technologies to monitor the real-time locations of responders, resources, and affected areas, enabling targeted and efficient disaster response through IDRIS.

Integrated Disaster Response Information System (IDRIS) - A centralized digital platform developed for the Ramon Aboitiz Foundation Inc. (RAFI) to streamline and automate disaster response functions such as volunteer management, donation tracking, resource allocation, damage assessment, and logistics coordination, providing real-time data for decision-making.

LGU Representative - Acts as the official liaison for a Local Government Unit. Responsible for updating LGU and barangay profiles, submitting local damage and needs assessments, and coordinating with IDRIS for resource requests and disaster data management.

Local Government Unit (LGU) - Administrative divisions in the Philippines (e.g., provinces, cities, municipalities, barangays) responsible for local governance and disaster response coordination; their data and operations are managed within IDRIS.

Logistics Coordination - Management of procurement, inventory, warehousing, packing, transport, and distribution of relief goods and resources to ensure efficient delivery during disaster response, as executed within IDRIS.

Logistics Officer - Manages the movement, storage, and distribution of goods and resources. Oversees procurement, inventory, warehousing, packing, transportation, and distribution to ensure timely delivery of relief items and supplies.

Operations Officer - Responsible for overseeing and coordinating the overall administrative and operational processes within IDRIS, including finance, reporting, and compliance. Ensures smooth day-to-day operations and supports decision-making during disaster response.

Ramon Aboitiz Foundation Inc., (RAFI) - The primary admin, and initiator of this digital platform, IDRIS.

Real-Time Data - Information collected, processed, and made available instantly within the IDRIS platform to support timely decision-making and operational transparency during disaster events.

Resource Allocation - Distribution and deployment of supplies, funds, and personnel to affected areas based on real-time needs and data, optimized through IDRIS's integrated modules.

Volunteer Management - The systematic process of registering, organizing, notifying, and assigning volunteers for disaster response activities, facilitated by IDRIS with real-time notifications and assignment tracking.

Volunteer - Registers and participates in disaster response activities. May be assigned to specific tasks or locations, receives notifications, and provides on-the-ground support as needed through the volunteer management module.

References

Alampay, E. A., Soriano, C. R., & Baldo, D. R. (2021). *Digital governance for disaster resilience in the Philippines: Challenges and opportunities*. Asian Journal of Public Administration, 43(2), 120-140.

AlertTech. (n.d.). *Damage assessment module*. Retrieved April 2, 2025, from https://www.alerttech.com/Modules/DamageAssessment

Alexander, D. (2018). *Natural disasters: Understanding the impact and response mechanisms*. Oxford University Press.

Department of Science and Technology (DOST). (2022). *Project NOAH: Enhancing disaster preparedness through real-time hazard mapping*. Retrieved from https://www.dost.gov.ph

Asian Disaster Reduction Center (ADRC). (2018). *Country Report 2018: Philippines*. Retrieved from https://www.adrc.asia/countryreport/PHL/2018/Philippines_CR2018B.pdf

Atlassian. (n.d.). *Jira service management*. Retrieved April 2, 2025, from https://www.atlassian.com/software/jira/service-management

BambooHR. (n.d.). *Performance management software*. Retrieved April 2, 2025, from https://www.bamboohr.com/p2

Biñas, J. P., & Mercado, R. A. (2024). *Real-time disaster response and decision-making in the Philippines: Challenges and opportunities*. International Journal of Disaster Science, 15(3), 212-229.

Capacity for Disaster Reduction Initiative (CADRI). (2020). *Good practices in integrated risk information systems*. Retrieved from https://www.cadri.net/system/files/2021-09/CADRI%20-%20Good%20Practices%20-%20Integrated%20risk%20information%20systems_2020.pdf

Coughlin, S. S., Clary, C., Johnson, J. A., & Berman, A. (2016). *Digital volunteer coordination in disaster response: A review of emerging technologies and frameworks*. International Journal of Disaster Risk Reduction, 17, 204-214.

Cruz, M. J. (2024). *Disaster preparedness and response in the Philippines: Challenges of local government units*. Philippine Journal of Public Policy, 30(1), 45-63.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319–340. https://doi.org/10.2307/249008

Dharmaraj, S. (2024). *Optimizing disaster response with integrated information systems: Lessons from global initiatives*. Disaster Management Review, 18(2), 100-118.

Esri. (n.d.). *Emergency management operations solution*. Retrieved April 2, 2025, from https://www.esri.com/en-us/c/industry/public-safety/emergency-management-operations-solution

Fernandez, G., & Ahmed, I. (2020). *Geographic Information Systems in disaster response: Mapping affected areas for optimized relief distribution*. Journal of Disaster Studies, 14(2), 78-94.

Haddow, G., Bullock, J., & Coppola, D. P. (2021). *Introduction to emergency management* (7th ed.). Butterworth-Heinemann.

ISO/IEC. (2001). *ISO/IEC 9126-1:2001: Software engineering—Product quality—Part 1: Quality model*. International Organization for Standardization.

Joshi, A., Kale, S., Chandel, S., & Pal, D. K. (2015). Likert scale: Explored and explained. *British Journal of Applied Science & Technology, 7*(4), 396–403. https://doi.org/10.9734/BJAST/2015/14975

Kim, J., Park, H., & Lee, S. (2019). *Mobile-based disaster response platforms: Enhancing efficiency in emergency situations*. International Journal of Emergency Management, 25(3), 187-205.

Kumar, R., & Havey, N. (2021). *Role of ICT in disaster management: Improving real-time communication and coordination*. Information Systems for Disaster Risk Reduction, 12(1), 42-59.

Labanan, R., & Lacasandile, A. (2020). *Development of an Information-Based Dashboard: Barangay Resident Information System and Services (BRISS) for Decision Support towards e-Governance*. International Conference on Science, Engineering, and Technology.

Lacasandile, M., & Labanan, P. (2020). *Enhancing disaster resilience through integrated management systems: A case study of LGUs in the Philippines*. Journal of Risk and Disaster Studies, 14(1), 87-103.

Lacasandile, M., & Labanan, P. (2020). *Enhancing disaster resilience through integrated management systems: A case study of LGUs in the Philippines*. Journal of Risk and Disaster Studies, 14(1), 87-103.

Liu, Y., Zhang, P., & Chen, W. (2019). *ICT-driven disaster management: Automated processes, real-time tracking, and resource allocation*. Disaster Management Review, 11(4), 215-233.

Padagdag, J. (2018). *Developing an integrated digital disaster response system: A case study of the Philippine Red Cross*. Philippine Journal of Emergency Management, 6(1), 55-72.

Park, H., & Lee, S. (2019). *The South Korean Emergency Response Coordination System: A model for integrated disaster management*. Journal of Public Administration, 36(2), 98-113.

Philippine Disaster Resilience Foundation (PDRF). (2021). *Strengthening disaster response through digital solutions: Challenges and innovations in the Philippines*. Retrieved from https://www.pdrf.org/publications

Philippine Disaster Resilience Foundation (PDRF). (n.d.). *Challenges in local government disaster response and the need for digital transformation*. Retrieved from https://www.pdrf.org/research

Philippine Red Cross (PRC). (2022). *Volunteer management and disaster response: Addressing coordination challenges in large-scale crises*. Retrieved from https://www.redcross.org.ph/reports

Rajan, R., & Srivastava, S. (2021). *Artificial intelligence in disaster response: Predictive modeling and response optimization*. International Journal of Disaster Risk Reduction, 33(5), 210-226.

Reyes, J., Cruz, M., & Dela Peña, R. (2020). *Development and Implementation of an Office Automation System for Barangay Local Government Units*. Journal of Information Technology and Governance.

U.S. Department of Homeland Security. (2025). *The impact of natural disasters on human life and economic stability*. Retrieved from https://www.dhs.gov/reports

United Nations International Strategy for Disaster Reduction (UNISDR). (2020). *Interoperability in disaster response: Enhancing coordination between organizations*. Retrieved from https://www.unisdr.org

United Nations Office for Disaster Risk Reduction (UNDRR). (2020). *Challenges in global disaster response: The need for integrated solutions*. Retrieved from https://www.undrr.org/publications

Wang, L., & Zhao, X. (2020). *GIS-based disaster response mapping: Optimizing relief efforts in the 2019 China floods*. Journal of Geographic and Disaster Studies, 17(1), 145-163.

World Bank. (2021). *Challenges in disaster communication: Overcoming infrastructure limitations in developing countries*. Retrieved from https://www.worldbank.org