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CHAPTER I

THE PROBLEM AND ITS BACKGROUND

1.1 Introduction

The current emergency management systems (EMS) face significant challenges in effectively responding to public safety disasters and unforeseen crises. These systems, while crucial, often struggle to reduce loss of life and property destruction due to limitations in infrastructure and technology. This underscores the urgent need for innovative solutions like Grab Rescue.

With the mass acceptance of smartphones, accentuated by the exponential increase in their use during the pandemic, another route has opened up to accessing emergency services. In Southeast Asia alone, smartphone users have grown to 326.3 million in 2022 and will likely expand consistently through 2026 (Cheung, 2022). Enhancements of the EMS can be made possible with GPS injections, harnessing the potential of contemporary technology for better community service at times when it matters most.

The team consulted representatives from the San Rafael, Bulacan Municipal Disaster Risk Reduction Management Office (MDRRMO), the Bureau of Fire Protection (BFP), and the Philippine National Police (PNP) in their research. According to the respondents, there is an urgent need for accurate location information and verifying the citizen's request for urgent emergency assistance. Currently, the MDRRMO, BFP, and PNP face considerable difficulties as they rely primarily on handheld phones and radios for communication. This study dials up an easy-to-use application that streamlines citizens sending an emergency request along with accurate location tracking and providing crucial information to ERT (Emergency Response Team). This study gets to the heart of emergency management's problems by proposing reasonable fixes and enhancing the EMS in place. This operates on a cloud-based database, which provides fast and secure data handling and integrates GPS technology for locating reporters with ERT, reducing response time and potentially saving lives.

1.2 Background of the Study

Accidents can happen regardless of one's level of experience. According to data from the World Health Organization (WHO) and the Philippine Statistics Authority (PSA), there were 11,096 yearly deaths in 2021 alone, namely from accidents that year (Junio, 2023). This idea means there will be a higher number if there are other accidents and deaths due to other reasons. That is why good emergency response management is essential while utilizing the current technological advancements to make it more efficient and effective.

The project team has developed an application, Grab Rescue, which has the potential to significantly enhance emergency response management. This user-friendly application, equipped with global positioning system (GPS) technology, is designed to assist the accident victim and the responding authorities. With its innovative features and user-friendly interface, Grab Rescue could improve emergency response management in Bulacan, making the audience feel at ease with the technology.

The capstone project team has not worked in isolation. It analyzed and used the data collected from research and considered suggestions to improve the application. This study values collected inputs and looks forward to further collaboration with the people on both sides of the emergency, making everyone feel included and part of the solution.

1.3 Objectives of the Study

a) To design a web-based mobile application, Grab Rescue, that facilitates quick and efficient emergency response services.
b) To design a user-friendly interface that enables seamless communication between citizens and rescue teams.
c) To develop Grab Rescue: Empowering Emergency Response with GPS-Driven Rescue Management.
d) To conduct pilot assessment in the Municipality of San Rafael

e) To evaluate the developed application project using ISO 25010, for IT Experts, in terms of:

   a. Functional Suitability
   b. Performance Efficiency
   c. Compatibility
   d. Usability
   e. Reliability
   f. Security
   g. Maintainability
   h. Portability

f) To evaluate the developed application project using TAM with non-IT experts, in terms of:

   a. Perceived Usefulness
   b. Perceived Ease-of-Use

1.4 Conceptual Framework

This capstone project, Grab Rescue, aims to enhance the current emergency response system by integrating modern technologies inspired by Grab's ride and delivery services. Existing emergency systems often need help with timely response times and a lack of real-time tracking of the location of both emergency responders and requesting citizens. These issues can significantly hinder rescue efforts, especially in critical situations.

Grab Rescue addresses these limitations by leveraging real-time GPS tracking, automated notifications, and streamlined workflows. The system connects citizens in emergencies with trained rescuers, providing a faster, more efficient, and notably user-friendly solution for handling emergency requests. By adapting proven concepts from GrabCar and GrabFood—such as real-time location monitoring, request notifications,

and progress tracking—the project seeks to redefine how emergencies are managed, ensuring timely assistance and better coordination among all stakeholders.

The conceptual framework shown in Figure 1.0 outlines the integration of Citizens, Rescuers, and Admins into a unified system, emphasizing collaboration and technology-driven solutions to improve emergency response efficiency.

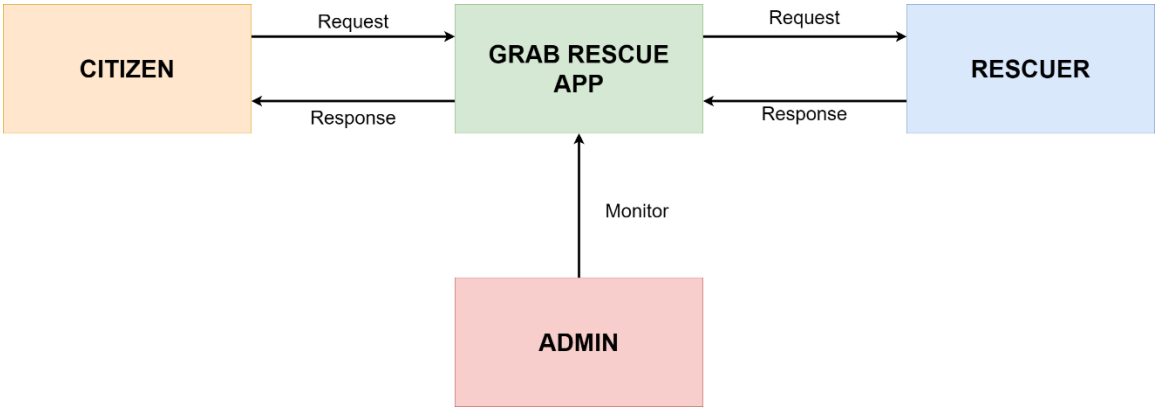

Figure 1.0 Grab Rescue Conceptual Framework Model

The Grab Rescue Application draws core inspiration from Grab Car and Grab Food, adapting their real-time processes for emergency response scenarios. Just as Grab connects passengers with drivers and customers with delivery riders, Grab Rescue links distressed citizens with trained rescuers through GPS technology. By incorporating features like real-time location tracking and notifications to nearby rescuers, Grab Rescue aims to deliver faster, more reliable emergency responses.

Grab Rescue is built around three distinct user roles—Citizen, Rescuer, and Admin—each tailored to specific responsibilities to ensure efficient emergency response. The system mirrors the seamless experience of Grab's services, enabling all users to navigate the process efficiently and feel familiar and comfortable with the system.

The Citizen initiates rescue requests through the app, selecting the required assistance type, such as help from the Philippine National Police (PNP), Bureau of Fire Protection (BFP), or MDRRMO. After submitting the request, they can track their assigned rescuer's real-time location on the map and receive status updates, such as

"Pending," "Assigned," or "En Route," providing transparency throughout the process. The real-time tracking and notifications ensure citizens feel secure and informed about the progress of their requests.

The Rescuer trained professionals from organizations like the PNP, BFP, and MDRRMO, logged in to the system, marked their availability, and responded to nearby emergency requests. Upon accepting a request, rescuers receive all necessary details and navigate to the citizen's location. They provide status updates such as "In Transit" or "Rescued," ensuring effective communication with citizens and admins.

The Admin oversees the system, ensuring smooth operations through a centralized dashboard. Admins track the real-time locations of rescuers, monitor ongoing requests, and generate reports to optimize resources and improve response times in high-demand areas. They also manage rescuer registration and verification, ensuring only trained professionals handle emergency operations. Additionally, admins are responsible for coordinating with local emergency services and updating the system with relevant information to ensure effective emergency response.

By connecting citizens, rescuers, and admins in a collaborative system, Grab Rescue leverages real-time tracking, seamless communication, and intuitive design to provide a faster and more reliable solution for emergency response, just as Grab does for its other services.

1.5 Scope and Limitations of the Study

The Grab Rescue capstone project focused on analyzing current information, studies, and systems to develop an innovative GPS-based emergency management system. This system includes real-time data processing capabilities through GPS integration, enabling reporting and receiving of data between citizens and responders. Grab Rescue is accessible on mobile devices, provided they have internet connectivity (via Wi-Fi or mobile data), making it widely accessible. The application is designed to identify and notify the nearest rescuer in the place of the incident. Experts and trained authorities will assume the roles of rescuers in each municipality or city. In contrast, available Municipal Disaster Risk Reduction and Management Office officers

will assume the administrator role. Grab Rescue also includes real-time location tracking and shows the shortest route to the incident, which enables fast and accurate responses to situations in the local municipality.

The Grab Rescue capstone project encounters limitations related to the quality of data provided by users and the accuracy of GPS readings. The application's reliability and precision are heavily dependent on the information received from these sources. Currently, the service is limited to the province of Bulacan, with initial testing being conducted in the Municipality of San Rafael. The main objective of the application is to send notifications and reports to nearby emergency management offices. For optimal performance, the mobile device needs to have a camera, GPS, and an internet connection. However, the application is not tailored for users with disabilities, as it assumes the ability to interact with the device for location reporting and emergency notifications. In urgent situations, users may find it difficult to access their smartphones quickly, which could delay response times and impact the effectiveness of the assistance provided. Furthermore, the notification feature has not been reliably sent to all devices due to certain device compatibility and security issues.

Furthermore, location services rely on the device's ability to rapidly and accurately determine the user's position, which means that the speed and accuracy with which the user is located is determined by the quality of the user's smartphone or the user's internet connection speed. Instead of operating as a native application, the Grab Rescue Application is web-based, which means it works in a browser. Both iOS devices and Android devices can use it. Grab Rescue will be available on the Google Play Store for Android users. Grab Rescue can be accessed by iOS users using an internet browser; Google Chrome is the suggested browser for optimal performance.

1.6 Significance of the Study

This study is conducted to benefit the following:

Developers of Emergency Management Systems. Future developers may leverage the gathered data from this research to gain an initial understanding of an EMS. With this knowledge, they may create a system incorporating real-time data

processing, GPS functionality, and seamless communication, providing a solid foundation for further development.

Future Researchers. Future researchers may utilize this study as a benchmark for creating EMS, offering methodologies and technologies for future innovation and evaluation. Building upon the insights and findings presented may contribute to improving emergency management systems.

Citizens Residing in Municipalities of Bulacan. Residents may benefit from the robust features of EMS, which enable efficient emergency requests and prioritized assistance based on urgency. It may ensure that residents promptly receive the help they need during critical situations.

Victims and Witnesses of Emergency Situations. The victims and witnesses may experience the benefits of swift assistance and coordination with responders through real-time communication and data sharing. This project may facilitate a rapid, effective response, minimizing the impact of emergencies and enhancing overall safety within the community.

Emergency Responders. The emergency responders may optimize their workflow with the timely information, prioritization, and resource allocation provided by the EMS. It also enables them to respond to emergencies more efficiently, improving their effectiveness in mitigating risks and saving lives.

CHAPTER II

REVIEW OF RELATED LITERATURE AND STUDIES

2.1 Review of Related Literature.

Emergency Management System

Grab Rescue, a web and smartphone application designed to improve emergency response, is highly effective in using Global Positioning System (GPS) to report accidents and their locations and then notify the nearest emergency team. The current study aligns with the study conducted by Navarro, Zaballos, and Sans (2022), underscoring the importance of effective communication technologies during emergencies. While their study suggested using multiple technologies like radio waves and drones, Grab Rescue focused only on GPS technology for real-time accident reporting. This approach may ensure quick and reliable communication, enhancing the overall efficiency of emergency responses. Moreover, the ongoing development of Grab Rescue is crucial, promising even more effective emergency response in the future.

GPS Location Tracking

While Grab Rescue and Automatic Accident Detection and Rescue Systems aim to improve emergency response, Grab Rescue stands out for its simplicity and reliance solely on GPS technology, lacking automatic accident detection features. In contrast to the advanced systems discussed in Kumar's (2022) study, this straightforward approach ensures that even in areas like Bulacan, where emergency responses rely on essential technologies like the closed-circuit television (CCTV) and handheld radios, Grab Rescue's GPS-based reporting is highly effective. By quickly notifying nearby emergency teams of accidents, Grab Rescue plays a crucial role in enhancing the speed and efficiency of assistance, filling a gap in emergency response

capabilities. The simplicity of Grab Rescue instills confidence in its usability and reassures the audience of its effectiveness.

The literature of Pervez et al. (2018) discussed the importance of wireless technology in emergency response, especially with smartphones. These devices have GPS and sensors to facilitate efficient alert notification and response coordination, even in challenging circumstances. In contrast, Grab Rescue takes a straightforward approach, relying only on the GPS function of smartphones. While less complex, its simplicity can be advantageous when time is of the essence and ease of use is crucial, particularly in areas like Bulacan. Its practicality ensures quick deployment and ease of use, making it a practical and effective tool in emergencies. This practicality of Grab Rescue instills confidence in its real-world application, making the audience feel secure about its use in emergencies.

Mobile Application

The article by Carreras-Coch et al. (2022) discussed the importance of quick communication during disasters. Smartphone applications can spread important info fast and help everyone work together. These apps are easy to access, so anyone can join in and get updates. It all adds up to better response and saving lives. Grab Rescue fits in because it is one of these applications. It uses GPS to report emergencies quickly. It is all about ensuring help gets where it is needed quickly.

Alshareef and Grigoras' (2016) article highlighted the growing importance of social media and mobile technology in disaster response. They discussed how emergency response apps use features like GPS and text-based communication to improve cooperation and communication during emergencies. Grab Rescue fits into this idea by using GPS to report emergencies quickly. While Alshareef and Grigoras discussed various emergency applications, Grab Rescue focused on using GPS to help people quickly get help.

Grab Related

According to Huang et al. (2019), the application of GPS technology in logistics demonstrates its effectiveness in optimizing real-time location tracking, route planning, and providing accurate estimated arrival times. These features significantly enhance operational efficiency, user satisfaction, and decision-making in dynamic environments. In "Grab Rescue," such technology can be pivotal in emergency response management by enabling precise rescuer navigation, timely updates, and improving response times. This integration of GPS-driven systems can streamline rescue operations, ensuring quick and effective responses to emergencies ultimately saving lives and resources.

Ride Hailing

According to the article of Danny Iland, et al.(2018) The challenges Uber faces with GPS accuracy in urban environments can directly relate to GrabRescue's need for precise location tracking in emergency situations. In densely built-up areas, both Uber and GrabRescue must contend with GPS inaccuracies caused by tall buildings and other obstructions that block or reflect satellite signals. For Uber, this results in unreliable location estimates for drivers and riders, which affects the efficiency of their service. Similarly, GrabRescue depends on accurate location tracking to direct rescuers to the exact location of emergencies. To address this, Uber has developed a software solution that improves GPS performance in urban areas by integrating 3D maps and advanced signal processing algorithms, which account for these environmental challenges. GrabRescue could benefit from a similar approach, using 3D maps and algorithms to enhance the tracking of rescue teams and citizens in need, ensuring that response times are as fast and accurate as possible. Additionally, Uber employs probabilistic algorithms that help predict the most likely location based on available data, even when GPS signals are weak or blocked. This technique could be used in GrabRescue to improve the location estimates of emergency responders, reducing the risk of misdirected or delayed assistance during critical situations.

2.2 Review of Related Studies

Emergency Management System

Padilla-Juaneza (2018) introduced a mobile application for the Municipality of Hinigaran that uses SMS and GPS to improve emergency response. This application helps citizens get quick aid and allows organizations to respond fast, boosting safety and communication during emergencies. Similarly, Grab Rescue uses GPS to report emergencies quickly. While Padilla-Juaneza's (2018) application uses Short Message Service (SMS) and GPS, Grab Rescue focuses on GPS to ensure that help arrives quickly. Both applications aim to make emergency response faster and more efficient.

Garcia's (2019) research found that people like using smartphone applications for emergency hotlines. However, there are issues with how easy they are to use, especially for those in stressful situations or with disabilities. Garcia suggested making the applications easier to use and adding features like sending location and details to emergency centers immediately to help response times. Grab Rescue fits in by using GPS to report emergencies quickly. While simple, it ensures emergency teams get important details fast. Garcia's research and Grab Rescue aim to make getting help during emergencies easier and faster.

Khan et al. (2018) discussed a system that improves emergency response by automating detection and notification. This is crucial for swift assistance, especially in fatal accidents where victims cannot call for help. This parallels Grab Rescue's aim to expedite response by using GPS to report accidents swiftly. Additionally, the real-time tracking in both systems aids responders in quickly reaching emergencies, reducing response times. By enhancing coordination between victims and responders, Grab Rescue, like the system described by Khan et al. (2018), seeks to improve outcomes during emergencies, increasing survival chances and minimizing injury severity. The role of Grab Rescue in improving coordination among responders is a critical factor in its impact on the overall efficiency of emergency response, making the audience feel the efficiency of emergency response.

GPS Tracking

In contrast to Grab Rescue, Deokate et al.'s (2022) Android-based HELP Application features user registration and one-time password (OTP) verification, granting access to emergency services via a categorized dashboard. The HELP Application utilized smartphone GPS to display nearby services, enhancing its effectiveness during emergencies. While Grab Rescue lacks a login feature, it shares the goal of leveraging GPS functionality for swift emergency response, aligning with the HELP Application's aim to provide automatic rescue capabilities through smartphone technology.

Callo and Mocheche Simion's (2019) study highlighted the pressing need for a better emergency response to road accidents in Kenya, which resonates with Grab Rescue's objectives. The study proposed a mobile and web application for real-time accident reporting, similar to Grab Rescue's focus on leveraging smartphone GPS for enhanced coordination among responders. Both initiatives aim to address the shortcomings of manual reporting systems, prioritizing real-time incident reporting to improve response times and save lives. This connection underscores the shared goal of using technology to optimize emergency response efforts.

De Luna's (2020) study on "HELP BRO": A Mobile Application for Calamities and Disaster emphasized the importance of GPS technology in improving emergency response, much like Grab Rescue. Both applications use smartphone features, especially GPS, to make rescue missions faster and more effective during crises. "HELP BRO" lets users ask for help and talk to nearby rescuers by tracking their location in real time with GPS. This shows how smartphone apps can play a significant role in managing disasters and responding to emergencies. Both "HELP BRO" and Grab Rescue aim to use technology to help people quickly and efficiently during emergencies.

Zualkernan (2018) discussed the Crash Detect application, which improves emergency response to accidents. It uses technology like artificial intelligence and GPS to make emergency services better. 'Crash Detect' identifies accident types and sends essential info to EMS. Its goal is to track accidents and get help from nearby responders quickly. In connection to Grab Rescue, 'Crash Detect' shows how smartphones can help during emergencies, using GPS and other tech to make responses faster and more effective. While Grab Rescue focuses on quick reporting and coordination, 'Crash Detect' improves response by detecting accidents early and sending essential details quickly.

Amat et al. (2023) developed a Smart Accident Detection and Emergency Notification System with GPS and GSM Integration. Using GPS and Global System for Mobile Communications (GSM) technology, their device swiftly relays accident information, including location and time, to nearby emergency services. This efficient alert system aids in rapid emergency response, potentially saving lives. This parallels Grab Rescue, which heavily relies on GPS technology to swiftly report accidents and summon nearby emergency teams, underscoring the critical role of GPS in enhancing emergency response.

Mobile Application

The SOS application that Pastrana(2021) described and Grab Rescue aims to improve emergency response for road accidents using smartphones. They both detect accidents and alert nearby help quickly. However, SOS includes medical details for responders, while Grab Rescue focuses on quickly coordinating with emergency services like police and hospitals using GPS. So, while they share a goal, Grab Rescue's GPS-based tracking sets it apart for swift emergency response.

Tabia's study (2021) outlined the effectiveness of the "Help Me" emergency response app in Dingle, Philippines, which differs from Grab Rescue's approach. While Grab Rescue focuses on swiftly reporting accidents using GPS

technology, "Help Me" directly alerts key authorities in Dingle during emergencies. While both apps aim to enhance emergency responses, Grab Rescue prioritizes GPS-based coordination with nearby services, whereas "Help Me" emphasizes direct communication with local authorities. Despite their differing approaches, both apps contribute to improving overall emergency response capabilities in their respective contexts.

Hidayanto (2021) studied what makes people want to use the X-Igent Panic Button app for automatic smartphone emergency help. They found that factors like how well the app works, trust in the service provider, and privacy concerns influence people's decisions. This shows how important these apps are for safety, especially in places like Indonesia, where technology is still growing. Similarly, Grab Rescue aims to improve safety through smartphones, but it works differently. While X-Igent focuses on automatic responses, Grab Rescue helps by quickly reporting emergencies and coordinating with help. Both highlight the value of smartphone apps for safety, even though they focus on different aspects.

Gomathy (2022) discussed a system that quickly alerts nearby medical centers about accidents, especially involving two-wheelers. Using an Android app, it sends text messages with the accident's location to contacts and the closest medical facility for faster emergency help. In contrast, Grab Rescue also speeds up emergency response but in a different way. Instead of directly notifying medical centers, it uses GPS to report accidents and call the nearest emergency team, which may include medical help. Both aim to improve emergency assistance, but Gomathy's system focuses more on alerting medical centers, while Grab Rescue handles various emergencies.

Lin's (2020) research shows how vital mobile tech is in healthcare, especially during emergencies like accidents. They looked into an emergency app's usefulness and found that people liked it and thought it worked well. This suggests that apps like Grab Rescue could improve emergency response. While Lin's study is about an

emergency app in Taiwan, Grab Rescue does a similar job using GPS to report accidents and call for help. Both use mobile tech to improve emergency response, just in different places. Lin's study shows how helpful emergency apps can be, which supports Grab Rescue's goal of helping during emergencies.

Tusnio's (2018) study focuses on the challenges in emergency response, like quick communication and coordination. The mobile applications discussed provide solutions by letting users report incidents, get alerts, and connect with rescue services or nearby helpers. These applications use smartphones and real-time tech to make emergency response faster and more efficient, filling gaps in existing systems. They also empower people to help during crises, improving public safety and response times. This relates closely to Grab Rescue's technology approach, including GPS, to report accidents and summon help swiftly. Both initiatives aim to enhance emergency response through mobile apps and real-time communication, illustrating how technology can play a vital role in improving public safety during crises.

Rey et al. 's (2022) study focused on the "Mamamayan" app in Makati City, Philippines, allowing users to report crises quickly. Through tests and evaluations, the app showed high usability and user satisfaction. It highlights mobile apps' role in enabling swift emergency responses and effective crisis communication. Similar to Mamamayan, Grab Rescue aims to enhance public safety by providing a more effective way of communicating during disasters. Both use mobile tech to empower users to report emergencies and communicate efficiently with responders. They share the goal of utilizing technologies for better emergency response and public safety.

Grab Related

Drawing inspiration from the usability assessment of the Grab mobile application, as conducted by Hussain et al. (2018), Grab Rescue can leverage established principles of GPS-enabled ride-hailing platforms to optimize emergency

response management. The study highlights the importance of user-friendly interfaces for efficient navigation, task execution, and satisfaction in technology-driven services. With insights into usability challenges, such as navigation accuracy and task efficiency, Grab Rescue can integrate these findings to enhance its GPS-driven rescue management system, ensuring seamless user experience during critical emergencies.

According to Abdullah et al. (2023), the rapid growth of online food delivery applications, especially following the COVID-19 pandemic, has prompted service providers to evaluate critical factors that influence customer preferences and ensure sustainable growth. The study employed a Fuzzy Analytical Hierarchy Process (FAHP) within a multi-criteria decision-making framework to assess the criteria that are most important to consumers when choosing an online food delivery application. The findings revealed that the most important criterion was economics, with delivery cost being the highest priority, followed by technology, service quality, and social and environmental considerations. For Grab Rescue, similar factors such as cost-effectiveness, efficient technology, and high service quality are essential for optimizing its emergency response system. By applying these insights, Grab Rescue can enhance its operational efficiency and provide a better user experience, ensuring that rescuers can respond promptly to citizens' needs while maintaining customer trust and satisfaction.

According to Bare et al. (2021), drawing inspiration from the study on online food delivery applications in the Philippines, Grab Rescue can leverage insights into critical factors that influence user satisfaction and operational efficiency. The study highlights the importance of delivery time, security, and customer service in the performance of service-based platforms. By understanding these factors, Grab Rescue can optimize its emergency response system to ensure faster response times, better security for both rescuers and citizens, and an overall user-friendly experience. Incorporating these findings will help Grab Rescue address challenges like timely

assistance and the protection of personal information, ultimately enhancing its effectiveness as a GPS-driven rescue management platform.

According to Md Saada, Niea, and Yaacob (2023), the sentiment analysis of customer experiences with online food delivery services, specifically GrabFood and Foodpanda, provides valuable insights into consumer expectations and satisfaction. The study utilized RapidMiner and the VADER lexicon-based technique to analyze tweets from X (formerly Twitter), revealing that both GrabFood and Foodpanda garnered a higher proportion of positive sentiment compared to negative sentiment. GrabFood, in particular, received more positive feedback. The content analysis identified key themes such as service quality, customer experience, pricing, and app issues, all of which are critical factors in shaping customer satisfaction. These insights are valuable for Grab Rescue as they highlight the importance of monitoring customer sentiment to ensure a positive user experience. By addressing key themes like service quality, timely responses, and user-friendly interfaces, Grab Rescue can enhance its effectiveness in emergency management and improve overall user satisfaction, similar to how food delivery services have optimized their offerings based on customer feedback.

According to the study of Rahman, et al.(2022), The study on online food delivery services, particularly Grab Food, provides valuable insights that can be applied to the Grab Rescue platform, especially in terms of customer trust and satisfaction. While the focus of the study is on food delivery, the same principles can be adapted to emergency management services. For instance, the quality of the Grab Rescue app plays a crucial role in building user trust, similar to how the quality of Grab Food's app influences customer trust in food delivery services. If the Grab Rescue app is easy to navigate, reliable, and provides prompt, accurate information during emergencies, users are more likely to trust it as a vital tool for emergency response. Additionally, customer satisfaction in Grab Rescue can be significantly impacted by the app's user experience. Just as the convenience of ordering food via Grab Food is key to customer

satisfaction, the convenience of using Grab Rescue, including quick response times, real-time tracking of rescue teams, and seamless interaction with local authorities, can contribute to a positive user experience. When these features function efficiently, they foster satisfaction and encourage users to rely on Grab Rescue in future emergencies, much like customers depend on food delivery services for their daily needs.

According to Banuelos, et al (2024). The study's comparison of leading food delivery applications highlights the critical role of app performance in driving user satisfaction and loyalty. Similarly, Grab Rescue can prioritize delivering consistently high performance across all service stages—requesting help, coordination, response, and follow-up. Ensuring reliability, responsiveness, and user-friendly functionality will be crucial to establishing trust and fostering loyalty among its users, akin to how Grab Food achieved superior ratings in the competitive food delivery market.

Food Delivery Related

According to Ahmad et al. (2023), the post-pandemic period has provided food delivery services with an opportunity to improve their operational efficiency, especially for platforms like Foodpanda. This study, which focused on customer satisfaction with the Foodpanda online delivery application, highlighted key factors such as customer service quality, food variety, and promotional efforts as critical determinants of customer satisfaction. These findings suggest that to enhance user satisfaction, Foodpanda must prioritize improving service quality and use strategies that foster customer loyalty. For Grab Rescue, similar strategies could be applied to ensure customer satisfaction in emergency response situations. Prioritizing service quality, such as timely assistance and clear communication, while also ensuring that the platform's offerings are easily accessible and user-friendly, could enhance the user experience for both rescuers and citizens. By focusing on these factors, Grab Rescue can increase customer trust and improve overall effectiveness in emergency management.

According to the study of Chotigo and Kodono (2021), the comparing factors influencing the adoption of food delivery apps before and during the pandemic provides insights relevant to Grab Rescue. For instance, external factors like trust, convenience, application quality, and satisfaction, identified as critical drivers of app usage, align closely with the needs of an emergency response app like Grab Rescue. Building trust and ensuring convenience and high application quality could significantly influence user engagement and loyalty to the app.

According to the study of Bokingkito, et al (2024), the increasing reliance on digital platforms to enhance service delivery, as seen in food delivery apps, highlights the importance of efficient design, functionality, and operational models. Similarly, Grab Rescue can adopt strategies to optimize user experience and operational workflows, particularly in urban environments where demand for swift emergency responses is high. Insights into improving app efficiency and addressing service challenges, such as delays and user satisfaction, can be directly applied to enhance its functionality.

According to the study of Shu-Hua Wu (2022), mobile applications offering precision, real-time information, and innovative service assistants significantly enhance user intention and satisfaction. Similarly, Grab Rescue can leverage real-time GPS tracking, precise routing for responders, and efficient communication to fulfill user needs during emergencies. By integrating these advanced features, Grab Rescue can improve its reliability and responsiveness, fostering greater trust and increasing its adoption and continued usage among citizens.

Ride Hailing

The Study of Ramizo Jr (2019) discusses the social impacts of ride-hailing technologies like Uber, Grab, and GoJek in Southeast Asia, particularly focusing on the daily lives of drivers and passengers. The study uses qualitative methods such as interviews and direct participation to explore both the positive and negative aspects of these technologies. It emphasizes how technological issues, platform algorithms, and social realities affect users and suggests that these findings can inform policy development for better integration of ride-hailing technologies into society. Relating this to GrabRescue, the study's exploration of how technology impacts users' lives can inform the development of GrabRescue, an emergency management system that uses real-time location data for better disaster response. Similar to how ride-hailing technologies improve functionality and socio-economic welfare, GrabRescue has the potential to enhance public safety by providing faster and more efficient rescue operations. However, just as the study notes that ride-hailing technologies face challenges such as technological limitations and algorithmic issues, GrabRescue could encounter similar obstacles, such as GPS inaccuracies in urban areas, communication barriers, and difficulties with algorithmic dispatching of rescue teams. Additionally, the study's findings on the interaction between technology and users—where both drivers and passengers face challenges in the use of ride-hailing platforms—can serve as a valuable insight for GrabRescue. It highlights the importance of minimizing friction between users (e.g., citizens requesting help) and operators (e.g., rescue teams) to ensure that technology serves the public good effectively in emergency situations. Therefore, GrabRescue should consider these social impacts and user interactions in its design and implementation to improve its social integration and effectiveness during crises.

2.3 Technical Background

2.3.1 Technicality of the Project

By referencing related studies and using related literature as a guide, the group gathered technologies to create the software. As the project progresses, additional frameworks and tools that have yet to be mentioned can still be incorporated.

The automated response/rescue application enables the local rescue team to locate an emergency and send help. Technologies are needed to accomplish the project, such as GPS, databases including PostgreSQL and Firebase, and the IDE and programming languages used for the development. These are the key technologies that can be used while conducting this study.

2.3.2 Technologies Used

The web-based application has a MapBox API to access location-based services. By retrieving the device's geographical coordinates (latitude and longitude), the application can use location-related features like mapping, geocoding, and distance calculations.

The proponents utilized these elements of the MapBox API in developing the proposed mobile application. These features include Mapping, which uses location data to display interactive maps within the application, and Location Tracking, which allows the proposed mobile application to get real-time position updates.

PostgreSQL database functions store and manage data within the proposed mobile application. Key features include data storage, which efficiently stores and retrieves application data; performance, offering a lightweight and scalable database management system; and data security, which ensures secure data handling practices with features like encryption, role-based access, and transaction management.

The proponents used Visual Studio Code to develop the proposed Grab Rescue because of its wide support for frameworks and libraries. It offers features and tools

designed for web-based and mobile development. These built-in features support the frameworks and libraries that the proponents will use. These features include Extensions. VS Code marketplace offers many extensions extending its functionality, including support for different programming languages, themes, and tools. With native support for Windows, macOS, and Linux, Visual Studio Code provides a consistent development experience across these operating systems. Extensions for web development: Visual Studio Code has excellent support for web development, covering contemporary languages and frameworks like HTML, CSS, JavaScript, TypeScript, and others. These include extensions for debugging, formatting, and linting.

In addition to the main PostgreSQL database used for local data storage, the proponent implemented a backup solution using Firebase, a cloud-based platform provided by Google. Firebase is the backup database to store critical application data remotely, providing scalability, real-time synchronization, and enhanced data security features.

The proponents decided to use Firebase because of its features. It includes Real-time Data Synchronization; Firebase offers real-time synchronization, ensuring that data changes made on one device are immediately reflected across all connected devices. This feature is crucial for applications requiring up-to-date information, such as Grab Rescue's location tracking, Data Backup, and Restore; application data stored in Firebase is a secure backup, protecting against data loss due to device failures or other unforeseen circumstances. Users can restore their data seamlessly when switching devices or reinstalling the application. Moreover, for Authentication and Security, PostgreSQL has built-in support that protects database access, particularly for private data backups. PostgreSQL guarantees that only authorized users can read or modify the data by establishing user authentication.

2.3.3 How the project works

The development of the proposed Grab Rescue mobile application followed a structured approach consisting of distinct phases. In the planning phase, specific requirements for MapBox API integration, PostgreSQL database utilization, and Visual Studio Code development environment were gathered and documented, ensuring the end-user needs and technical specifications were clarified. Subsequently, during the designing phase, the system architecture was meticulously planned to incorporate MapBox API for mapping and real-time location tracking, alongside detailed database schema design using PostgreSQL and UI/UX design using Visual Studio Code to enhance usability. Moving into the development phase, the mobile application was implemented based on the finalized system design, integrating MapBox API for essential functionalities and implementing Firebase as a backup database solution for data security. Following development, rigorous testing, including unit and integration testing, was conducted to validate functionality and performance.

The application was prepared for distribution in the implementation plan phase, where the distribution channels are decided upon, and the deployment configurations will be optimized. Lastly, ongoing maintenance and support will be provided post-deployment, addressing user feedback promptly and continuously implementing updates and new features to enhance Grab Rescue based on user requirements and market trends. This structured approach ensures thorough planning and implementation of key features, leveraging technologies to deliver a robust and user-friendly mobile application experience.

CHAPTER III

METHODOLOGY

This chapter presents a comprehensive research plan detailing the data collection methods, tools, and their reliability. It also includes the analysis of data using statistics, the development of necessary software, and the specification of software and hardware requirements. Furthermore, it provides information about creating and testing a prototype, the budget needed, and the implementation plan, including infrastructure and deployment plans.

3.1 Phase 1

3.1.1 Research Methodology

The study employed mixed research methods, combining quantitative and qualitative data in a single study. Wasti et al. (2022) demonstrated that this approach leads to stronger conclusions than each. It contributes knowledge and insights that might otherwise be overlooked.

Quantitative methods focus on numeric data, such as the Likert Scale, ISO 25010, and Technology Acceptance Model, which evaluate the system's performance, usability, and reliability. These metrics provide measurable and objective insights into how well the system meets its intended goals, helping to identify strengths and pinpoint areas where improvements are needed. For instance, results from these evaluations can quantify how users rate the system's efficiency or ease of navigation, providing a clear benchmark for success. Qualitative methods, like interviews with rescue teams and users, offer a deeper understanding of their experiences, challenges, and feedback regarding the app. These methods allow researchers to gather detailed insights into how the app performs in real-world scenarios. Interview feedback can reveal specific issues, such as difficulties with certain features, lack of clarity in notifications, or suggestions for additional functionalities, which might not be apparent through numeric data alone.

Combining these two approaches gives the research a more comprehensive understanding of the Grab Rescue system. Quantitative data highlights trends and measurable outcomes, such as the overall scores from respondents' evaluations, while qualitative data provides context and depth, explaining the reasons behind users' satisfaction or dissatisfaction. For example, while quantitative results might indicate a high score for usability, qualitative feedback could reveal that users found certain features confusing at first but later appreciated their utility after repeated use. Together, these methods ensure that the Grab Rescue system is not only efficient in its performance but also user-friendly and responsive to the needs of its users, ultimately leading to better emergency response outcomes.

The project team has adopted an Agile methodology for this capstone project, ensuring an efficient workflow. This methodology divides The project process into several stages, such as the Software Development Life Cycle (SDLC). Planning, Design, Implementation, Analysis, and Maintenance are some stages. The project team's choice of the agile methodology is also driven by the importance of continuous feedback and the opinions of the respondents and soon-to-be users throughout the development process. A study conducted in Columbia about the use of Agile methodology concludes that IT professionals favor Agile methodology mainly because of features such as constant communication with the client (Parada et al., 2018). To get feedback and opinions and answer the project team's questions, the team conducted various surveys and interviews, both online and face-to-face.

3.1.2 Respondents

For this study, respondents were selected using random and purposive sampling methods to ensure a diverse and representative sample. Random sampling was used to select individuals from the populations of the municipality of San Rafael. For information related to rescue authorities and administrative users of the application, purposive sampling was employed to focus on officials from the San Rafael Municipal Disaster Risk Reduction and Management Office.

Respondents from the Municipality of San Rafael

Respondents	Frequency	Percentage
Citizen from the Municipality of San Rafael	**15**	**75%**
San Rafael MDRRMO, PNP, BFP	**5**	**25%**
Total	**20**	**100%**

Table 3.2 Respondents from the Municipality of San Rafael

IT Expert Respondents

Respondents	Frequency	Percentage
IT Experts	**5**	**100%**
Total	***5***	**100%**

Table 3.3 IT Expert Respondents

The formula below was used to get the total number of respondents from the proposed sampling methods:

$$R = P * N$$

Where:

P = Percentage

N = Population

R = Respondents

3.1.3 Instruments

The project team relied on ISO 25010, a specialized framework for IT professionals to evaluate software quality, often used in advanced projects like capstones. This standard provides technical criteria for defining, measuring, and assessing critical system attributes, such as functionality, maintainability, and portability. Its use, requiring IT expertise, allowed the team to conduct a detailed and reliable evaluation, ensuring the system's performance aligned with project requirements.

Indicators		**Responses**				
1. Functional Suitability		**1**	**2**	**3**	**4**	**5**
A. Functional Completeness	Address all the specified tasks and user objectives outlined in the projects design.					

B. Functional Correctness	Ensure that the accurate results are delivered with the required level of accuracy.					
C. Functional Appropriateness	Designed to facilitate accomplishment of the specified tasks. More precisely, the execution of the process.					
2. Performance Efficiency		**1**	**2**	**3**	**4**	**5**
A. Time Behavior	Time spent on processing a request and returning a response.					

B. Resource Utilization	How effectively and optimally a system utilizes its available resources to meet performance requirements without excessive consumption or wastage.					
C. Capacity	Ability to continue working even with large number of accesses at the same time.					
3. Compatibility		**1**	**2**	**3**	**4**	**5**
A. Co-Existence	Ability of a software system to operate alongside other systems					

	or components without interference or conflict.					
4. Usability		**1**	**2**	**3**	**4**	**5**
A. Learnability	Can facilitate the understanding of its functionality.					
B. Operability	The system is easy to understand and user-friendly.					
C. User Error Protection	The system provides error notification for invalid operations.					
D. User Interface Aesthetics	The user interface is designed to be visually					

	attractive an engaging for the user.					
E. Accessibility	The system is easy to access.					
F. Appropriateness Recognizability	Users can easily identify whether the developed system meets their needs and is suitable for their intended use.					
5. Reliability		**1**	**2**	**3**	**4**	**5**
A. Maturity	The system is anticipated to provide a response whenever a user requests information.					

B. Availability	The system remains consistently responsive to user interface, ensuring it is always available to use.					
C. Fault Tolerance	The system effectively identifies and handles errors, seamlessly returning to normal operation after detection.					
D. Recoverability	The system allows to recover forgotten passwords.					
6. Security		**1**	**2**	**3**	**4**	**5**

A. confidentiality	The system stores the personal information of its user into a secure database and can only be accessed to an authorized client.					
B. Integrity	System must be developed to prevent unauthorized access or changing private information without permission.					
C. Non-repudiation	The system is designed to avoid repeating the same action unnecessarily when carrying out a single task. (ex. Clicks on button)					

D. Accountability	System is autonomous, can operate independently.					
E. Authenticity	The system user has to be authenticated.					
7. Maintainability		**1**	**2**	**3**	**4**	**5**
A. Modularity	The system is composed of different modules which makes it easier to update or fix features without affecting other parts of the system.					
B. Reusability	Administrators can modify the system content to ensure it stays up to date.					

C. Analyzability	Examine the effect of modification on the system.					
D. Modifiability	The system provides administrative functions to allow changes in critical data.					
E. Testability	The system can be tested for functional use.					
8. Portability		**1**	**2**	**3**	**4**	**5**
A. Accessibility	The system can be access anywhere as long as you have internet connection.					

B. Installability	The system can be installed on any android mobile devices.					

Table 3.4 ISO 25010

The IT Experts were required to use the Five-Point Likert Scale to compare the time and efficiency between using the application and using the traditional hotline, as well as their satisfaction towards using the application.

Point	Mean	Description
5	**4.21-5.00**	**Excellent**
4	**3.41 - 4.20**	**Very Good**
3	**2.61 - 3.40**	**Good**
2	**1.81 - 2.60**	**Fair**
1	**1.00 - 1.80**	**Poor**

Table 3.5 Five-Point Likert Scale

This Five-Point Likert Scale table displays the equivalent of the respondents' and users' feedback towards the capstone project. 5 = Excellent, highest rating, 4 = Very Good, 3 = Good, 2 = Fair, 1 = Poor, lowest rating. The ratings on the different criteria were assessed using the formula:

$$M = \frac{5(r) + 4(r) + 3(r) + 2(r) + 1(r)}{R}$$

The Technology Acceptance Model (TAM) provides a framework for understanding how users adopt and interact with new technologies, focusing on two main factors: perceived usefulness and perceived ease of use. In the context of Grab Rescue, a service designed for emergency response, TAM helps explain user acceptance. Perceived usefulness evaluates how effectively Grab Rescue meets user needs, such as quickly connecting individuals with rescue services, facilitating clear communication during emergencies, and providing accurate location tracking and resource allocation. On the other hand, perceived ease of use focuses on the system's intuitive and straightforwardness, especially during high-stress situations. For example, users would assess whether the interface is easy to navigate, rescue teams can deploy resources efficiently, and whether the features are accessible to various user groups. By addressing these factors, Grab Rescue can ensure high adoption rates and effectiveness in critical situations.

Perceived Usefulness

	Likely						**Unlikely**
	Extremely	Quite	Slightly	Neither	Slightly	Quite	Extremely
1. Using Grab Rescue would help me respond to emergencies more quickly.							
2. Grab Rescue would improve the efficiency of my rescue operations.							
3. Using Grab Rescue would make it easier to coordinate rescue efforts.							

4. Grab Rescue would enhance my ability to communicate with citizens during emergencies.							
5. Using Grab Rescue would reduce delays in rescue operations.							
6. I would find Grab Rescue critical in successfully completing rescue missions.							

Perceived Ease-of-Use

7. Learning to use Grab Rescue for rescue operations would be							

straightforward for me.							
8. It would be easy for me to manage rescue requests using Grab Rescue.							
9. The interface of Grab Rescue would make it simple to track emergencies.							
10. I would find Grab Rescue's functions clear and understandable.							
11. It would be easy for me to teach others how to use Grab Rescue.							
12. I would find Grab Rescue							

intuitive and user-friendly for my tasks.							

Table 3.6 Technology Acceptance Model for Rescuers

Perceived Usefulness

	Likely						**Unlikely**
	Extremely	Quite	Slightly	Neither	Slightly	Quite	Extremely
1. Using Grab Rescue would help me get assistance more quickly in an emergency.							
2. Using Grab Rescue would improve my chances of resolving							

emergencies effectively.							
3. Using Grab Rescue would make it easier for me to report emergencies.							
4. Using Grab Rescue would enhance my confidence in managing emergencies.							
5. Using Grab Rescue would simplify the process of seeking help in emergencies.							
6. I would find Grab Rescue useful in managing emergencies.							

Perceived Ease-of-Use

7. Learning to use Grab Rescue would be easy for me.							
8. I would find it easy to use Grab Rescue for reporting emergencies or requesting help.							
9. My interaction with Grab Rescue would be straightforward.							
10. I would find Grab Rescue's interface clear and understandable.							
11. It would be easy for me to become skillful at using Grab Rescue.							

12. I would find Grab Rescue easy to use.							

Table 3.7 Technology Acceptance Model for Citizens

The seven-point Likert scale is an effective tool for gauging user attitudes, opinions, and perceptions by providing a range of responses from one extreme to another. This scale can measure perceived usefulness and ease of use in evaluating Grab Rescue through the Technology Acceptance Model (TAM) lens. For example, users might rate statements such as "Using Grab Rescue enhances my ability to respond effectively during emergencies" or "Grab Rescue is easy to navigate even in stressful situations" on a scale from 1 (Strongly Disagree) to 7 (Strongly Agree). This approach allows for more nuanced feedback, enabling the team to understand user acceptance levels and identify areas for improvement.

Point	Mean	Description
7	**6.21 - 7.00**	**Extremely Likely**
6	**5.41 - 6.20**	**Quite Likely**
5	**4.61 - 5.40**	**Slightly Likely**
4	**3.81 - 4.60**	**Neither Likely nor Unlikely**
3	**3.01 - 3.80**	**Slightly Unlikely**
2	**1.81 - 3.00**	**Quite Unlikely**
1	**1.00 - 1.80**	**Extremely Unlikely**

Table 3.7 Seven-Point Likert Scale

This Seven-Point Likert Scale table displays the equivalent of the respondents' and users' feedback towards the capstone project: 7 = Extremely Likely, the highest rating; 6 = Quite Likely; 5 = Slightly Likely; 4 = Neither Likely nor Unlikely; 3 = Slightly Unlikely, 2 = Quite Unlikely, 1 = Extremely Unlikely, the lowest rating. The ratings on the different criteria were assessed using the formula:

$$M = \frac{7(r) + 6(r) + 5(r) + 4(r) + 3(r) + 2(r) + 1(r)}{R}$$

3.1.4 Statistical Analysis of Data

The responses from the Municipality of San Rafael respondents served as the basis for the required data for this capstone project. The frequency was calculated using the formula:

$$P = \frac{F}{N} * 100$$

Where:

P = Percentage

F = Frequency

N = Total number of respondents

The citizens and rescuers from the Municipality of San Rafael used the Seven-point Likert scale to measure their statements regarding using the application project. IT Experts, on the other hand, used the Five-point Likert scale.

3.2 Phase 2

3.2.1 Requirements Analysis

The requirement analysis outlines the system's comprehensive specifications and functional needs, encompassing monitoring, managing, and filtering information. The system needs mobile devices using an Android operating system that can connect to a connection to install the proposed mobile applications.

The proponent has developed Grab Rescue, a web-based application primarily utilizing the **MapBox API**, designed for Bulacan residents. The application was developed using the **Visual Studio Code** platform. A PostgreSQL database is used to manage the application's data, and Firebase is the backup database for the proposed Web application. The proposed mobile application requires that the main interface be easy to use, clean, and user-friendly.

3.2.2 Requirements Documentations

Software Requirements

This requirement category includes all software applications and requirements used during development and after the proposed mobile application implementation.

1. **Programming Language, Stylesheet**

a. HTML - is a standard markup language for documents intended to be displayed in a web browser.

b. CSS - is a style sheet language used to specify the presentation of a document written in a markup language such as HTML or XML.

c. JavaScript is a programming language generally considered to be at the core of the Web, along with HTML and CSS.

2. **Frameworks/Libraries**

a. TailwindCss -is an open-source CSS framework. The main feature of this library is that, unlike other CSS frameworks like Bootstrap, it never provides a series of predefined classes for basic elements like buttons or tables.

b. React JS- React.js is a JavaScript toolkit for building user interfaces, primarily for single-page applications. It enables developers to efficiently design reusable UI components and manage states in their applications. Components and manage the state of their applications quickly.

c. Express - A Node.js web application framework called Express.js creates web servers and APIs. It makes managing middleware, routing and requests easier so that web applications can be developed rapidly and effectively.

d. Node.js - With the help of the JavaScript runtime Node.js, one may execute JavaScript scripts server-side and independently of a browser. It makes using JavaScript possible to create scalable web servers and network applications.

e. MapBox GL - A JavaScript library called Mapbox GL displays dynamic, modifiable maps in online applications. Rendering vector maps and controlling them with slick animations and user interfaces is made possible for developers.

3. Software Applications to be used in development

a. Adobe Photoshop – is mainly used to format pictures, apply computer manipulation techniques, perform graphic design, and manufacture logos.

b. ·Visual Studio Code -sIt has web browsers and is a source code editor that Microsoft created for Windows, Linux, and Mac OS X.

4. Database to be used for development

c. PostgreSQL – is a powerful open-source relational database management system that supports organizing data types into tables, SQL querying and management features, ensures data reliability using the ACID rule, provides more advanced data

management features such as full-text search, and JSON support and extensibility for custom data types and functions.

d. Firebase - It is a cloud-based database for backup, offering real-time data synchronization, thereby providing scalability and improved data security.

5. Design Software tool

a. Figma is used to create user interfaces, prototypes, and layouts for visualizing design, ideas, and features due to its intuitive interface and powerful design capabilities.

Hardware Requirements

A hardware compatibility list is typically presented alongside a hardware requirements list. The proponents strongly recommended improving the experience with the proposed mobile applications. The user is advised to meet the following requirements:

1. Mobile Device to be used for system implementation, minimum requirements.

a. Camera

b. Connection: Data Connection / Internet Connection

c. GPS: Internal or External GPS Receiver

2. Computer/Laptop to be used for system development

a. Processor: minimum of Intel Core i3 or AMD Ryzen 3 (or equivalent) and Intel Core i5 or AMD Ryzen 5 (or equivalent)

b. RAM: minimum of 8GB RAM and recommended 16GB RAM

c. Operating System: Windows 10 minimum or macOS Catalina

d. Storage: 500GB

e. Connection: Ethernet Connection / Internet Connection

f. GPS: Internal or External GPS Receiver

3. Computer/Laptop to be used for system implementation, minimum requirements

a. Processor: minimum of Intel Core i3 or AMD Ryzen **3** (or equivalent) and Intel Core i5 or AMD Ryzen 5 (or equivalent)

b. RAM: minimum of 4GB RAM and recommended 8GB RAM

c. Operating System: Windows 10 minimum or macOS Catalina

d. Storage: 128GB or 256GB higher

e. GPS: Internal or External GPS Receiver

f. Connection: Ethernet Connection / Internet Connection

Functional Requirements

The system supports three parts: the civilian, rescuers/operators, and admin.

Civilians should be able to:

- Request for help.
- Create Citizen Account
- Choose what type of help needed
- Notify the nearest rescuers and connect with them.
- Track the location of the rescuer assigned to them.
- Provide personal information and further incident details.

- Update Profile Information

Rescuers should be able to:

- Interact with emergency notification.
- Verify the information of the reporters and victims.
- View the emergency details.
- Accept emergency request
- Update Profile Information

Admin should be able to:

- Manage Rescuer Account.
- Create Rescuer Accounts
- Generate log reports
- Monitor incoming requests and ongoing rescues

Non-Functional Requirements

- Accessibility
- Efficiency
- Responsiveness
- Usability
- Reliability
- Security

3.2.3 Tech Stack

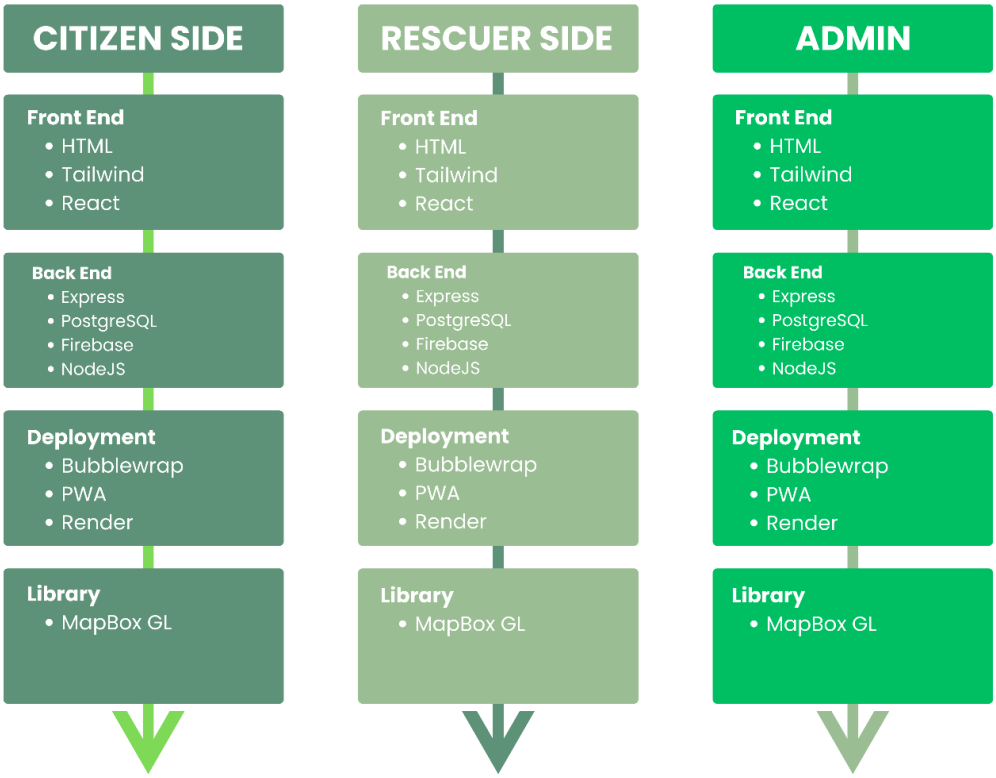

Figure 3.1 Grab Rescue Tech Stack

The Grab Rescue app's technology is divided into three primary components: **Admin**, **Rescuer Side**, and **Citizen Side.** To guarantee smooth integration and upkeep, all three sections use the same set of technologies. All jobs leverage **HTML**, **Tailwind**, and **React** on the front end to create modern, responsive interfaces. The back end uses **Node.js** to run **JavaScript** on the server side, **Firebase** for push notifications or real-time updates, **PostgreSQL** for data storage, and **Express** for server-side logic.

Bubblewrap transforms the web application into a Progressive Web App (PWA) for deployment, allowing for offline capabilities and app-like experiences. Render, a dependable platform for deployment, hosts the backend and services. Additionally, **MapBox GL**, a robust library for interactive maps, is integrated into the

program to provide essential location-based functions like navigation, tracking citizen requests, and locating nearby rescuers.

The **Rescuer** and **Citizen Side**s have the same Tech Stack, guaranteeing development efficiency and offering features customized for their responsibilities. Maintenance is easier using the same Admin section technologies intended for data administration and system monitoring. Overall, the selected Tech Stack prioritizes scalability, real-time functionality, and a consistent user experience throughout the application.

3.2.4 Design of Software Systems and Processes

During this stage, we are making a mock-up design of the whole system to see how it might look and work. We do this to make sure everyone understands how things work and to make any necessary changes early on before we start building the real system.

Victim Side

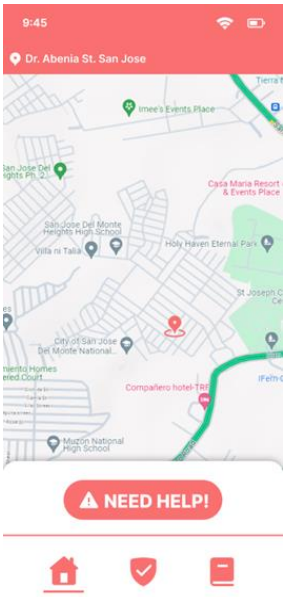

Figure 3.2 Grab Rescue Homepage

Figure 3.3 Warning Message

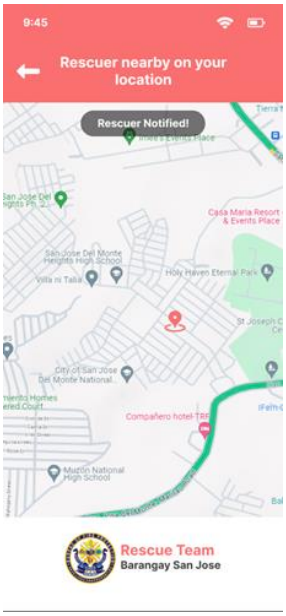

Figure 3.4 Grab Rescue Rescuers Received

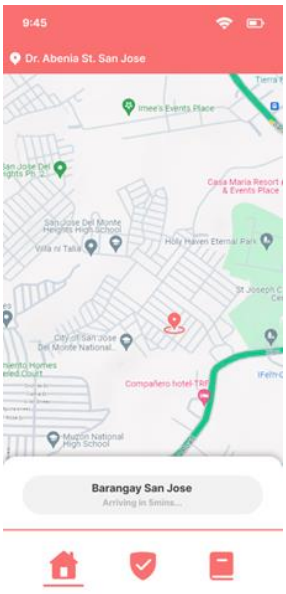

Figure 3.5 Notification

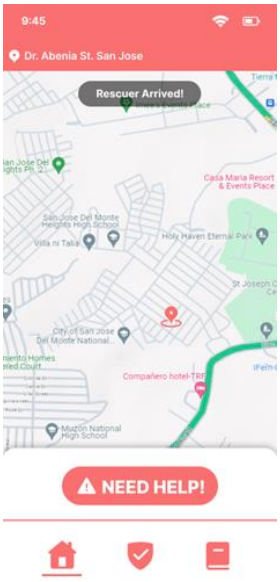

Figure 3.6 Rescuers Arrival

Figure 3.7 Grab Rescue Safety Tips

Figure 3.8 Hotlines

Rescuers Side

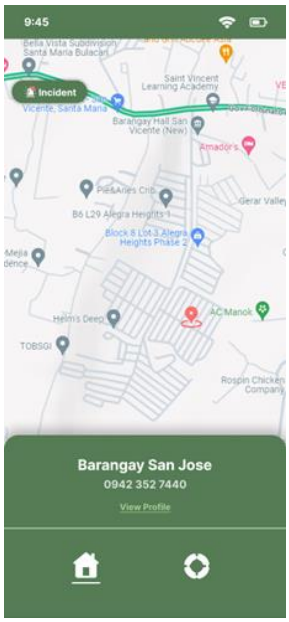

Figure 3.9 Rescuers Homepage

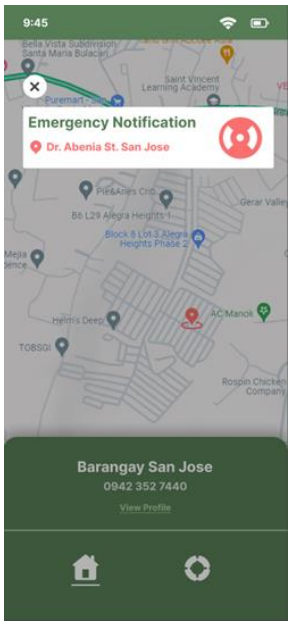

Figure 3.10 Emergency/Incident Notification

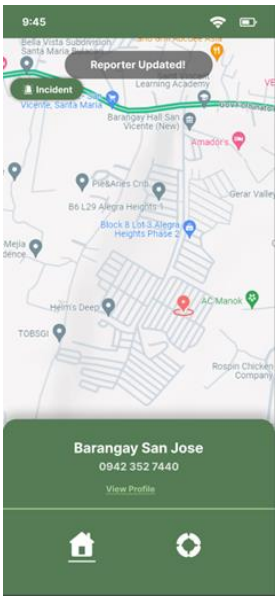

Figure 3.11 Update Victim

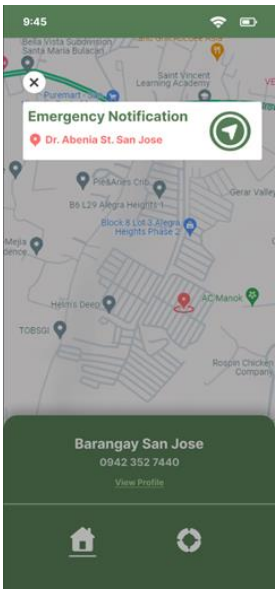

Figure 3.12 Deployment of Rescuers

Figure 3.13 Victim Report

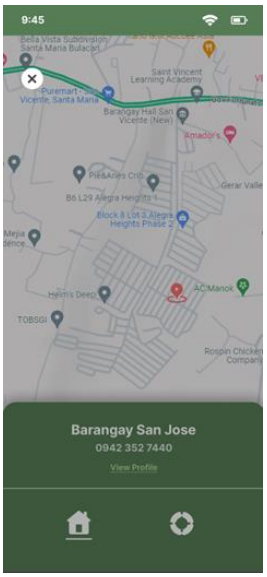

Figure 3.14 Automatically Clear Notification after they rescue

Admin Side

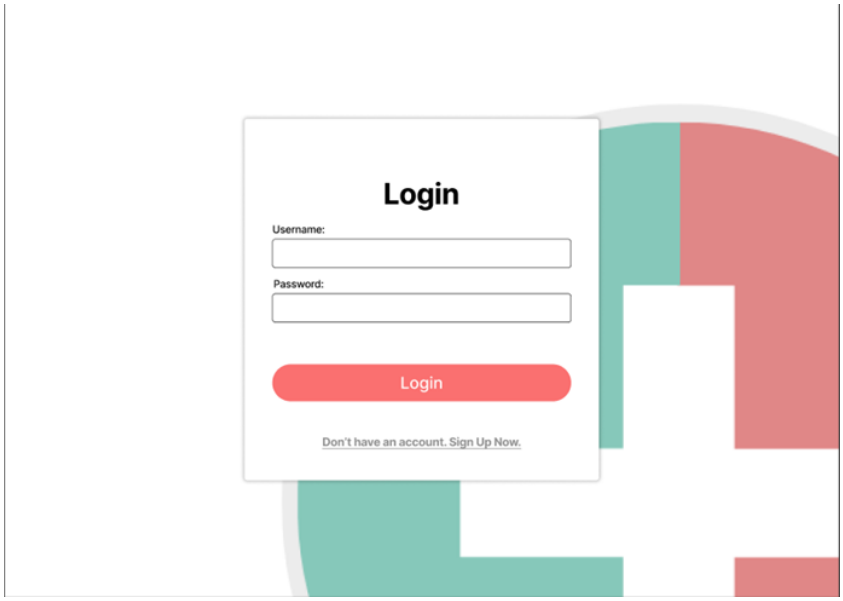

Figure 3.15 Admin Log in

Figure 3.16 Admin Sign up

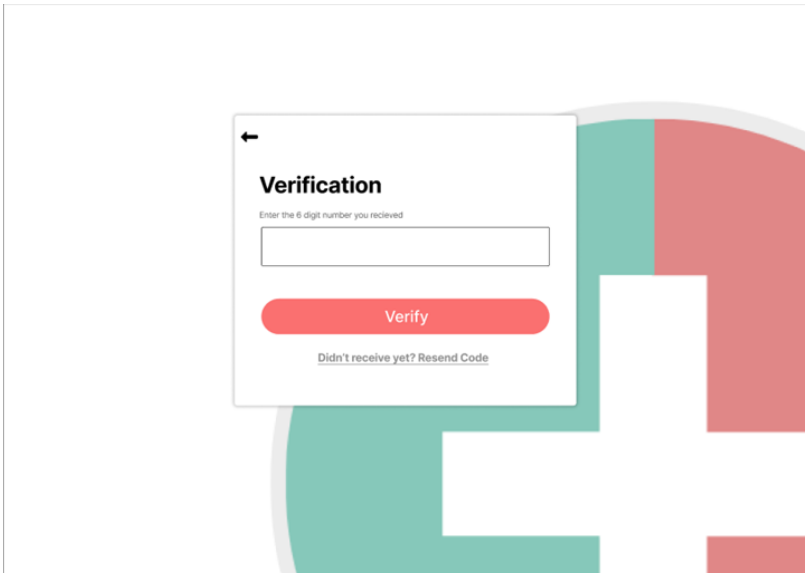

Figure 3.17 Admin Verification

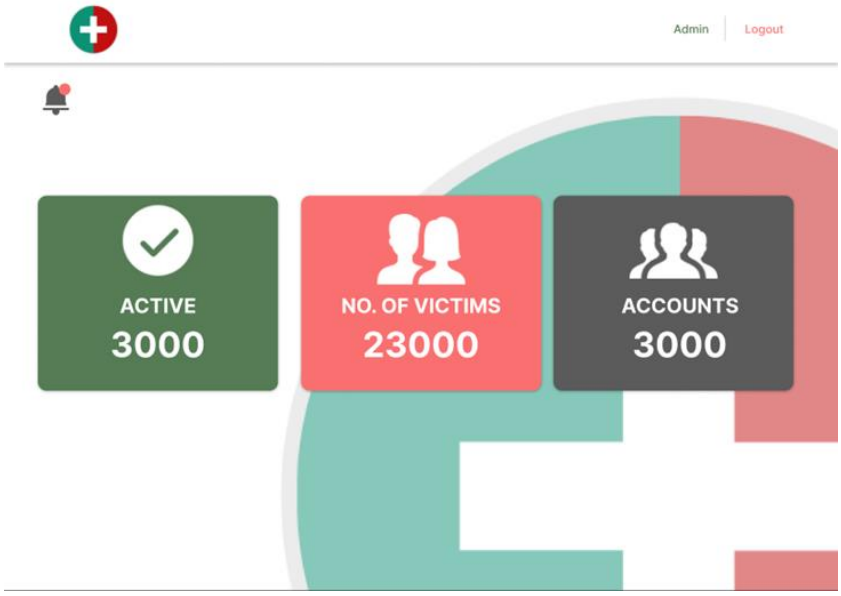

Figure 3.18 Admin Dashboard

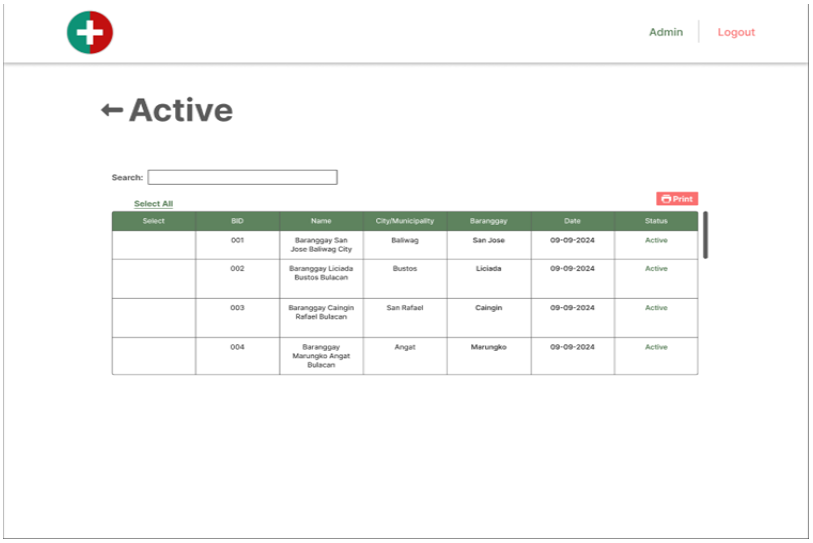

Figure 3.19 Active Page

Figure 3.20 Number of Victims

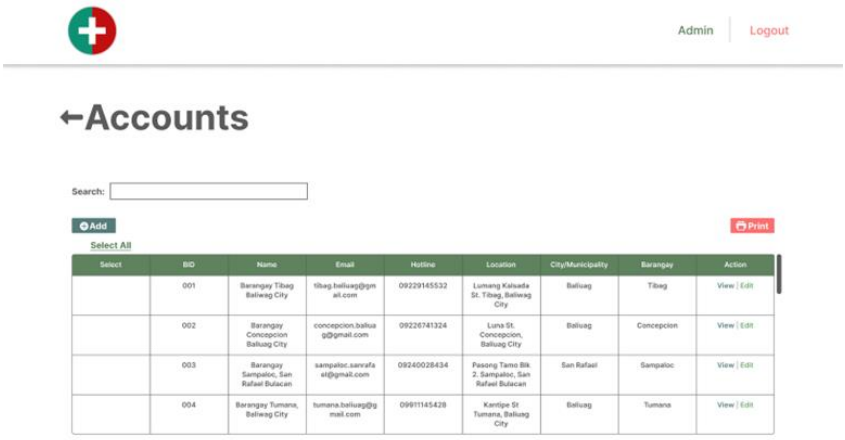

Figure 3.21 Accounts

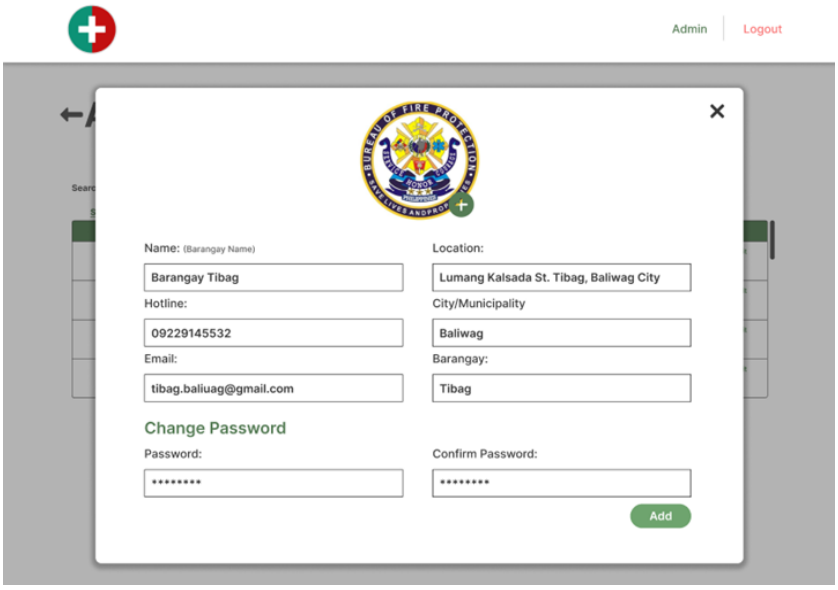

Figure 3.22 Add Account

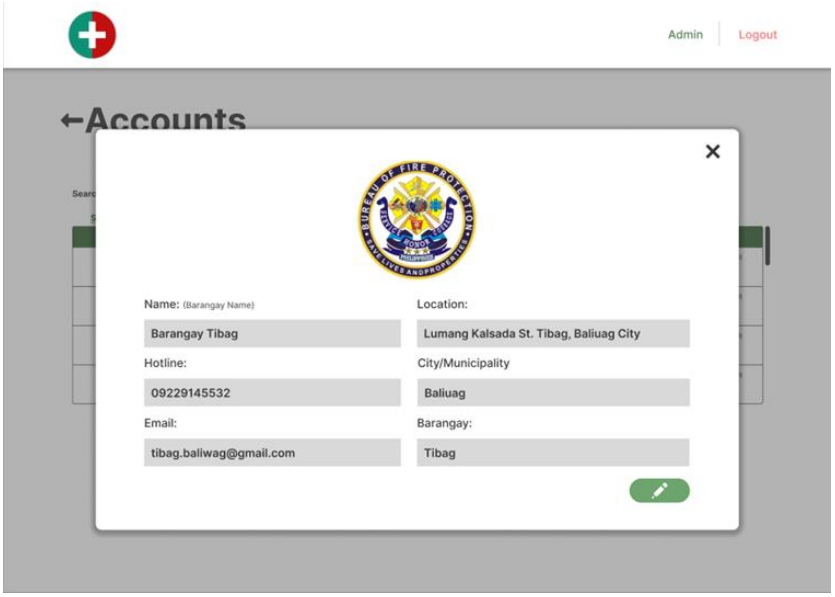

Figure 3.23 View Account

Figure 3.24 Edit Account

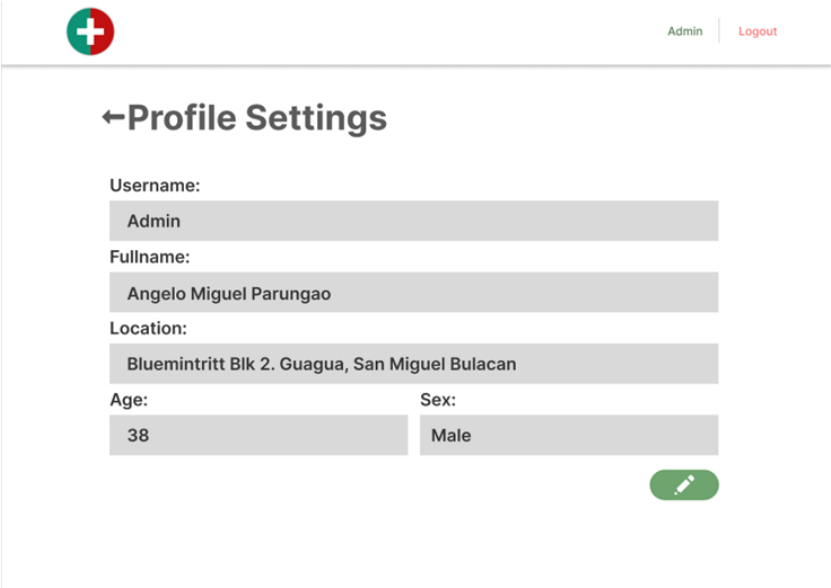

Figure 3.25 Admin Profile

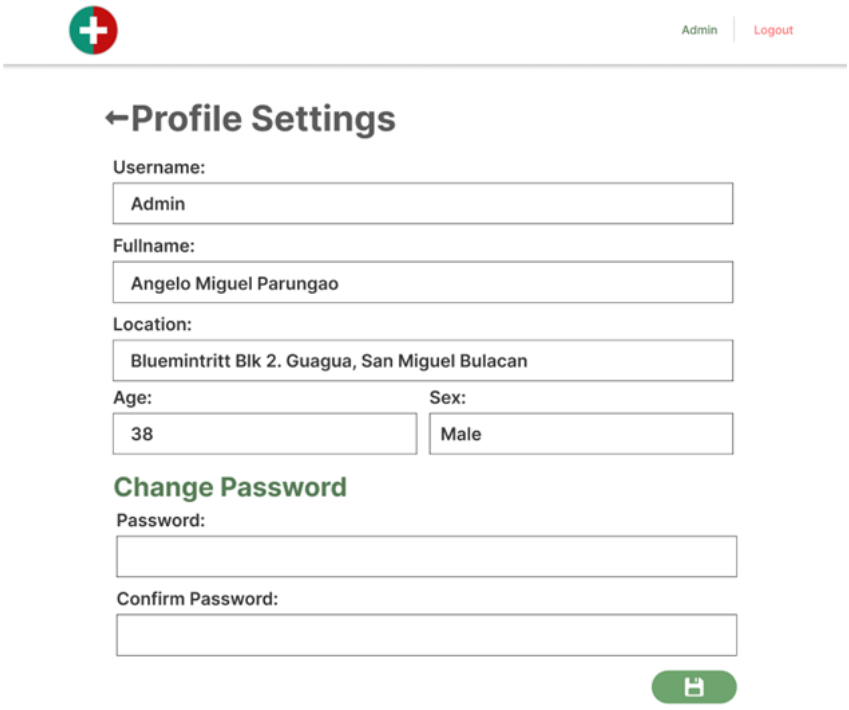

Figure 3.26 Edit Admin Profile

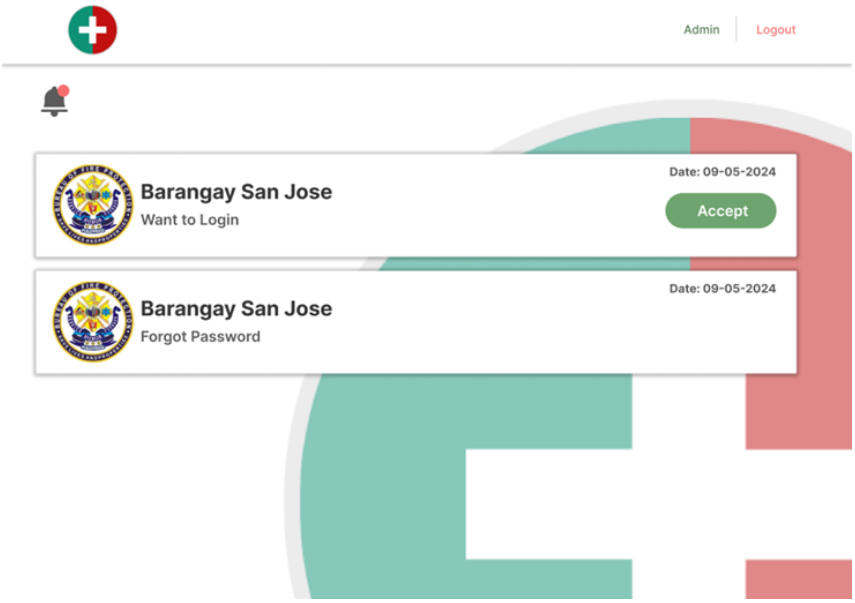

Figure 3.27 Admin Notification

3.2.4 Software Development Methods

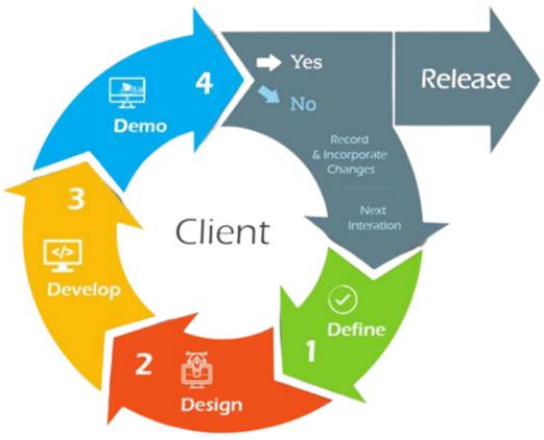

Figure 3.28 Agile Methodology

For the software development process of this capstone project, Agile Methodology was used for a more flexible and client-inclusive process, and it was able to implement changes depending on the remarks and feedback of the client, as shown in the figure above. The team chose the Agile methodology to avoid releasing an application, and the client or user would have feedback different from an earlier discussion.

3.2.5 Development and Testing

Planning. The planning phase of the project team involved various discussions and brainstorming sessions to develop the necessary ideas for the capstone project. This phase also included the distribution of roles and responsibilities for an efficient workflow towards the completion of the project.

Designing. In this phase, the team created the mock-ups and concepts for the project application. These concepts served as a blueprint to guide the team and the objectives laid out for the project in the project's development phase. This phase helped the team avoid unnecessary mistakes that caused a significant delay in implementing the completed application.

Development. After the project's design phase, the project team proceeded to the development phase. Using the designed prototypes, the project team carefully implemented the concepts the team came up with to create an application that follows the requirements and objectives of the project.

Testing. During the development stage of Grab Rescue, thorough testing is essential to ensure the application's smooth operation and reliability in emergencies. Testing is comparable to fine-tuning a critical system before deployment. Automated tests were conducted to verify key functionalities such as location tracking, alert notifications, and communication channels. Additionally, controlled testing environments simulate various emergency scenarios and assess how Grab Rescue performs under different conditions. The primary objective of this testing phase is to confirm that all features work correctly and consistently, ensuring Grab Rescue's effectiveness and readiness for deployment in real-life emergency response scenarios within the municipalities of San Rafael in Bulacan.

Functionality Testing

Functionality testing in Grab Rescue's development ensures that essential features like location tracking, emergency alerts, and communication functions operate reliably during emergencies in San Rafael, Bulacan. Automated tests verify proper functionality under various conditions, while controlled scenarios simulate emergencies to assess Grab Rescue's performance. This testing phase aims to confirm that all critical features work seamlessly, enabling Grab Rescue to support efficient responses in real emergencies and ensure its deployment readiness.

Interface Testing

Interface testing in developing Grab Rescue is crucial for ensuring the application's usability and effectiveness during emergencies in San Rafael, Bulacan. The user interfaces are assessed at this testing phase to ensure they are responsive, intuitive, and simple. To find and fix usability problems, interface testing evaluates how users engage with essential

features like location tracking and emergency notifications. By optimizing the application's interfaces through rigorous testing, Grab Rescue becomes more user-friendly in life situations.

Usability Testing

Usability testing is essential in developing Grab Rescue to ensure the application is intuitive and efficient for users during emergency responses in San Rafael, Bulacan. This testing phase evaluates how simple and efficient users can utilize the program to perform important functions like sending alerts or retrieving emergency information. Usability testing entails getting input from representative users to find usability problems or opportunities for improvement. Grab Rescue may be improved to offer a smooth and user-friendly experience, increasing its efficiency and usability in emergencies by considering user feedback and making the required modifications in light of usability testing results.

Performance Testing

Performance testing is crucial in developing Grab Rescue to ensure the application operates efficiently and reliably during San Rafael, Bulacan emergencies. This testing phase assesses how well Grab Rescue performs under various conditions, such as high user loads or limited network connectivity. Performance testing involves measuring response times, resource usage, and overall system stability to identify potential bottlenecks or issues impacting the application's performance during critical moments. Developers can optimize Grab Rescue to deliver fast and consistent performance by conducting thorough performance testing. This ensures it can effectively support rescuers and emergency responders in real-time scenarios with dependable functionality.

Security Testing

Security testing is essential for ensuring the reliability and safety of Grab Rescue during emergency responses in San Rafael, Bulacan. This

phase focuses on identifying and addressing potential vulnerabilities that could compromise sensitive data or communication within the application. By conducting thorough security testing, developers can implement robust measures such as encryption and secure authentication to protect user information and ensure the application's integrity in real emergencies. This helps maintain user trust and confidence in Grab Rescue as a secure and reliable tool for supporting rescuers and emergency responders.

Review. During this phase, the developers closely considered all user feedback regarding the system. This feedback may encompass suggestions for enhancements, bug reports, or issues encountered. The developers carefully examined the feedback to determine what was working well and what needed to be changed or improved to improve the system for users and meet their needs.

3.2.6 Implementation Plan

The project was implemented after its completion. The team conducted final testing and modifications to ensure the application was ready for deployment. This way, the team ensured that the application had no more major bugs and worked as needed.

Another step that the project team took was conducting multiple dry runs and training, especially for the rescuers who receive emergency notifications from the civilians who use the application to ensure it is used properly. These dry runs were conducted in the selected municipalities, San Rafael. The team asked for feedback and improved the application based on the feedback.

CHAPTER IV

PRESENTATION, ANALYSIS, AND INTERPRETATION OF DATA

This chapter highlights the significant results of the study based on the outcomes of the proposed system that support the study's objectives. It details the system's development process and examines how its implementation has influenced the intended beneficiaries. Additionally, this chapter discusses the system evaluation results, highlighting the system's performance, usability, and overall effectiveness in addressing the identified needs.

1. To design a web-based mobile application, Grab Rescue, that facilitates quick and efficient emergency response services.

   The integration of real-time features such as location tracking, notifying the nearest rescuer, and sending additional information like emergency descriptions and images is the most important part of designing Grab Rescue. These features address key challenges in emergency systems, such as delays due to miscommunication, uncertainty about rescuer arrival times, and the citizen’s exact location.

   With real-time location tracking, citizens can track the rescuer’s exact location and estimated arrival time, offering reassurance during emergencies. Additionally, real-time updates ensure the nearest rescuer is promptly notified, and the citizen's emergency details, including descriptions and images, are sent immediately. This enables rescuers to navigate efficiently and be better prepared for the situation, improving response time and minimizing delays.

Below are screenshots demonstrating how these real-time features work in action, highlighting how they accurately update the locations of both citizens and rescuers, notify rescuers of the emergency, and send essential information to ensure fast, efficient, and reliable emergency responses:

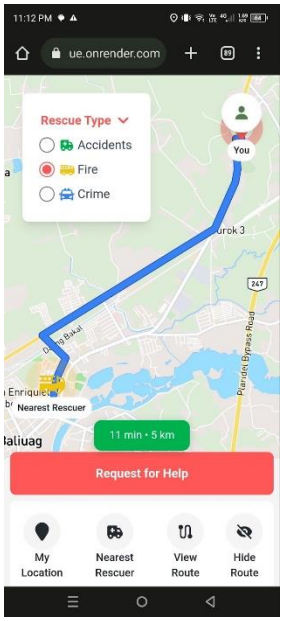

Figure 4.1 Real-time Distance and ETA of Nearest Rescuer From the Citizen

This figure above depicts a user interface from Grab Rescue showing a real-time tracking. It highlights the distance and estimated time of arrival (ETA) of the nearest rescuer to the citizen requesting help. The screen also allows users to select a rescue type (e.g., "Accidents," "Fire," or "Crime") and provides options like locating themselves, viewing or hiding the route, and requesting help. This feature aims to streamline emergency responses by visually guiding rescuers and citizens.

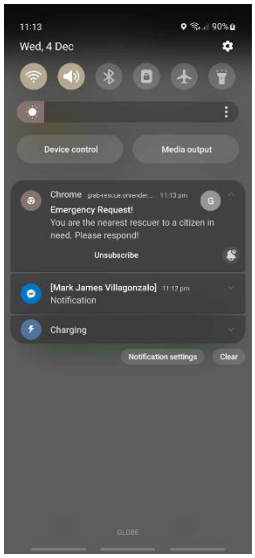

Figure 4.2 Real-time Notification Request from Citizen to the Nearest Rescuer

The figure above shows a notification panel where a rescuer receives real-time notification about an emergency request from a citizen. The notification includes details like the rescue type and the location of the incident, enabling the rescuer to respond promptly. This feature is designed to enhance communication and efficiency in emergency situations.

Figure 4.3 Real-time Incoming Request in Admin

The figure above displays the admin interface of the system, showing a real-time list of incoming emergency requests. The interface includes details like the location of the request and its status. This feature allows administrators to monitor and manage emergency incidents effectively, ensuring that requests are addressed promptly.

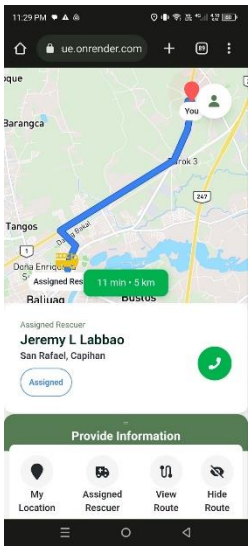

Figure 4.4 Real-time Request Acceptance and Assigned Rescuer Status

The figure illustrates the user interface displayed when an emergency request is accepted by the assigned rescuer. It also provides details about the assigned rescuer and includes a button to directly call the rescuer.

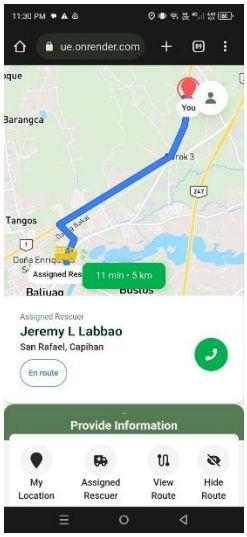

Figure 4.5 Real-time Rescue Status Changes

The figure above provides a snapshot of the real-time status updates from an assigned rescuer during an ongoing operation. The visual representation of the rescuer's journey, from the 'Assigned' status to the 'En Route' phase, offers valuable insights into the progress of the mission. This dynamic display enables efficient monitoring and coordination, ensuring timely assistance and effective resource allocation.

2. To design a user-friendly interface that enables seamless communication between citizens and rescue teams.

Grab Rescue's user interface is designed with a focus on simplicity and accessibility to ensure a smooth experience for all users. Citizens can quickly report emergencies and share their exact location with just a few taps, eliminating the need for manual address input and reducing response times. Rescuers can easily access real-time emergency requests, view essential details, and navigate efficiently to the emergency site.

On the admin side, the interface allows for comprehensive monitoring of incoming requests, ongoing rescues, and rescuer account management. Admins can track real-time updates, ensuring efficient coordination and effective management of resources throughout the rescue process. Additionally, there are tutorials in the application that will allow all users to easily learn how to use Grab Rescue.

Below are screenshots demonstrating how the interface simplifies emergency reporting, rescuer updates, admin monitoring, and app navigation:

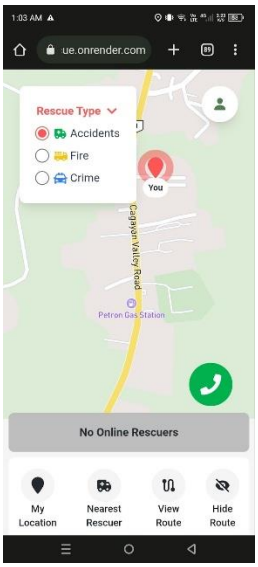

Figure 4.6 Citizen Side Navigation Buttons

The figure above displays the straightforward navigation buttons that the citizen can use to request for rescue.

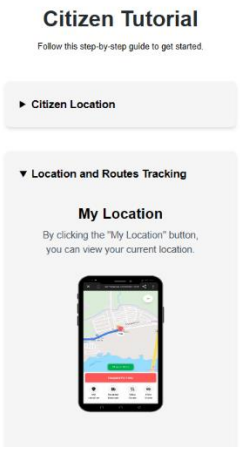

Figure 4.7 Tutorial for Citizen

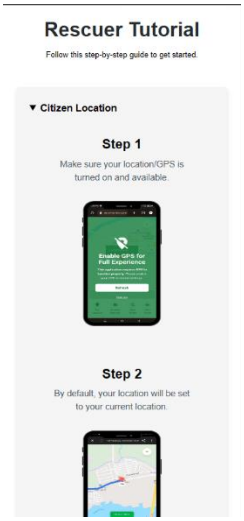

Figure 4.8 Tutorial for Rescuer

Figures 4.7 and 4.8 show the tutorial page of Citizen and Rescuer. Users can use the tutorial for step-by-step guides of how to use Grab Rescue.

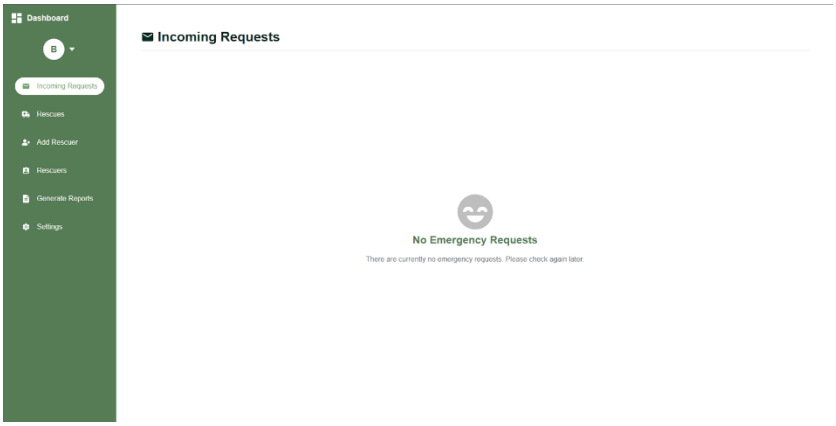

Figure 4.9 Incoming Request

This figure shows the incoming request that is still pending and has not been accepted yet.

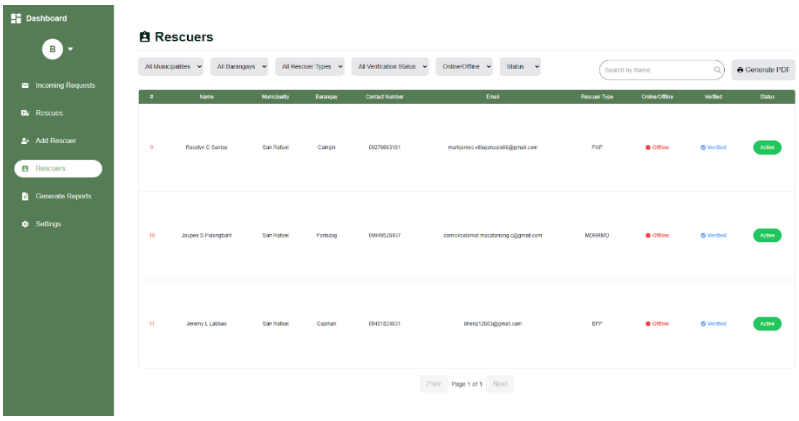

Figure 4.10 Rescuers Account

This figure shows the current registered rescuers, it also shows the personal details, department and the status of rescuer.

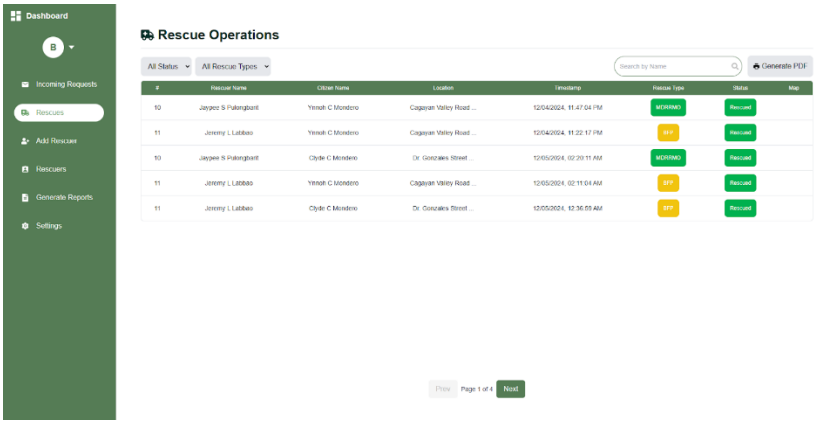

Figure 4.11 Rescue Operations

This figure shows the rescue operations that the rescuers conduct. it also shows the status of the rescue operation, rescue information, name of citizen, and the name of the assigned rescuer.

3. To develop Grab Rescue: Empowering Emergency Response with GPS-Driven Rescue Management.

The development of Grab Rescue focuses on overcoming communication barriers in emergency response, particularly in areas like San Rafael, where issues such as weak signals, inaccurate locations, and prank calls often slow down response times and put lives at risk.

This objective highlights how the GPS feature is central to Grab Rescue's development, helping to finalize a reliable, efficient emergency response system. By completing this feature, Grab Rescue provides seamless location sharing, accurate navigation, and quicker rescues.

Below are screenshots demonstrating how the core features of Grab Rescue—including GPS technology, real-time location tracking, and the user-friendly

interface—work together. These features allow accurate tracking of both the citizen's and rescuer's locations, ensuring quick, efficient, and reliable emergency responses.

a) Nearest Rescuer Tracking:

GPS helps identify the nearest available rescuer to the citizen in need, allowing the system to send notifications to the nearest rescuer regarding the emergency, further reducing the time needed to respond to the emergency.

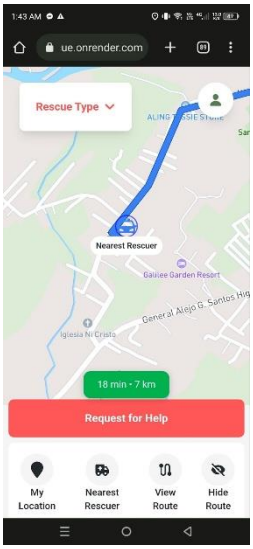

Figure 4.8 Location Tracking for nearest rescuer

The figure above shows how the app utilizes location tracking to get the citizen's current location and determine the nearest rescuer.

b) Citizen's Request with Their Current Location:

GPS automatically detects and shares the citizen's current location when they submit a rescue request, eliminating the need for manual address input and ensuring accurate location data.

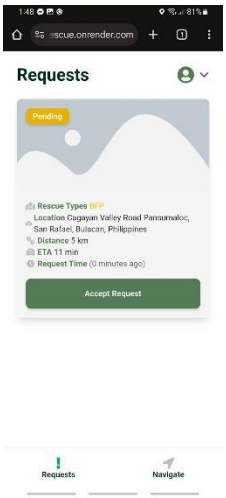

Figure 4.9: Location Tracking for Citizen's Current Location

The figure above illustrates how Grab Rescue uses location tracking to capture the citizen's current location, which is then used to send the rescue request.

c) Two-Way Routes for Citizens and Rescuers:

GPS technology enables the generation of real-time routes for both the citizen and rescuer, providing efficient directions to ensure both parties reach the emergency site as quickly as possible.

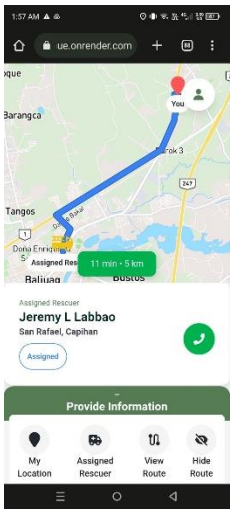

Figure 4.10: Citizen Side Location Tracking

Figure 4.11: Rescuer Side Location Tracking

The figures above demonstrates how the app tracks the real-time location of both the rescuer and citizen, helping the rescuer navigate to the emergency site efficiently and allowing the citizen to track the rescuer's location.

d) Admin Ongoing Rescues Monitoring:

GPS enables admins to monitor the real-time progress of ongoing rescues, track the location of rescuers, and oversee operational efficiency, ensuring effective resource management.

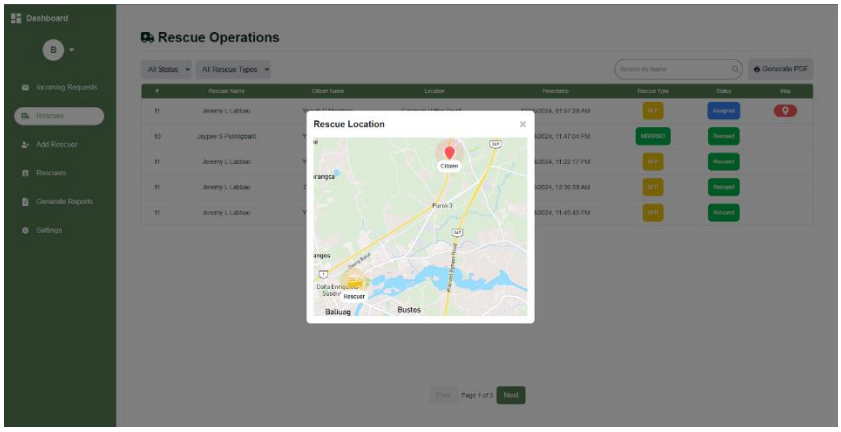

Figure 4.12: Monitoring for Ongoing Rescues

This figure illustrates how GPS and location tracking are used to assist admins in monitoring the current locations of rescuers and citizens being rescued.

4. To conduct pilot assessments of Grab Rescue in Municipality of San Rafael

We coordinated with the office of the mayor to give us permission To conduct pilot assessments of Grab Rescue in the Municipality of San Rafael for the key responders from various agencies, including the Philippine National Police (PNP), Bureau of Fire Protection (BFP), and the Municipal Disaster Risk Reduction and Management Office (MDRRMO).

1. **MDRRMO:**
    - **Mr. Jaypee Pulongbarit**: A Trained Rescuer from San Rafael MDRRMO; was the first to use the Grab Rescue app and provided feedback through the Technology Acceptance Model (TAM) survey.
    - **Mr. Ricardo Marcelo**: A Trained Rescuer from San Rafael MDRRMO; Conducted a simulation of actual usage scenarios to evaluate the app's effectiveness and reliability in real-life situations.
2. **BFP:**
    - **Fire Officer 1 Jeremy Labbao**: Tested the app from the perspective of fire and rescue operations and completed the TAM survey to provide valuable insights on its usability and applicability to their workflows.
3. **PNP:**
    - **Mrs. Rocelyn Santos**, the Public Information Officer (PIO) of the San Rafael Police Station, utilized the app and shared her observations, focusing on its relevance and efficiency for police operations.

These assessments allowed us to gather feedback from diverse perspectives, ensuring that the app's functionality meets the operational needs of different responders in emergency scenarios. The input from these key stakeholders will serve as the basis for further development and refinement of the Grab Rescue app.

5. To evaluate the developed application project using ISO 25010 standards with IT experts.

Functional Suitability

Indicators	**WM**	**Verbal Interpretation**
Functional Completeness	4.0	Very Good
Functional Correctness	4.0	Very Good
Functional Appropriateness	4.21	Excellent
Average Mean	4.07	Very Good

Table 4.1 Functional Suitability Evaluation

Table 4.1 shows the evaluation from IT Experts for Functional Suitability Section in ISO25010. Grab Rescue got average score of “4.0” which is Equivalent to “Very Good” from both Functional Correctness and Functional Completeness but the Functional Appopriateness indicators have slightly higher mean with score of “4.21” and considered as “Excellent” on the likert scale matrix, indicating that the functional suitability is viewed as passable from IT Experts standpoint.

Performance Efficiency

Indicators	**WM**	**Verbal Interpretation**
Time Behavior	4.0	Very Good
Resource Utilization	3.50	Very Good
Capacity	4.0	Very Good
Average Mean	3.83	Very Good

Table 4.2 Performance Efficiency Evaluation

Table 4.2 shows the evaluation from IT Experts for the Performance Efficiency Section in ISO25010. Grab Rescue got average score of “4.0” which is Equivalent to “Very Good” from both Time Behavior and Capacity Indicators but the Resource Utilization indicators have slightly lower mean with score of “3.50” but it still falls with the “Very Good” Category indicating that the performance efficiency is viewed as passable from IT Experts standpoint.

Compatibility

Indicators	**WM**	**Verbal Interpretation**
Co-existence	4.0	Very Good
Interoperability	3.50	Very Good
Average Mean	3.75	Very Good

Table 4.3 Compatibility Evaluation

Table 4.3 shows the evaluation from IT Experts for Compatibility Section in ISO 25010. Grab Rescue got average score of "4.0" for Co-existence indicators and have lower mean for Interoperability indicator with the WM of "3.50" but also considered as "Very Good". Overall the Average mean for compatibility for Grab Rescue is "3.75" equivalent as "Very Good", indicates that Grab Rescue can co-exist and have great Interoperability but there are always room for improvement.

Usability

Indicators	**WM**	**Verbal Interpretation**
Appropriateness Recognizability	3.66	Very Good
Learnability	5	Excellent
Operability	4.20	Very Good
Use error protection	4.20	Very Good
User Interface Aesthetics	5	Very Good
Accessibility	5	Very Good
Average Mean	4.51	Very Good

Table 4.4 Usability Evaluation

Table 4.4 presents the usability evaluation of Grab Rescue based on ISO 25010 standards, as assessed by IT experts. The results indicate that the system performs well across various usability indicators. Appropriateness Recognizability scored 3.66, interpreted as "Very Good," while Learnability and Accessibility both received perfect scores of 5, categorized as "Excellent." Operability and Use Error Protection each scored 4.20, and User Interface Aesthetics achieved a score of 5, all rated as "Very Good." The overall average mean for usability is 4.51, reflecting a "Very Good" rating, which highlights Grab Rescue's strengths in providing an

intuitive, accessible, and user-friendly interface. These results demonstrate that the system delivers a high level of usability, with significant strengths in its learnability, aesthetics, and accessibility.

Reliability

Indicators	**WM**	**Verbal Interpretation**
Maturity	4.0	Very Good
Availability	5	Excellent
Fault Tolerance	3.50	Very Good
Recoverability	3.50	Very Good
Average Mean	4	Very Good

Table 4.5 Reliability Evaluation

Table 4.5 shows the the reliability evaluation of Grab Rescue, based on ISO 25010 standards, shows strong performance across several reliability indicators. Maturity scored 4.0, interpreted as "Very Good," indicating a stable and reliable system. Availability received the highest score of 5, categorized as "Excellent," reflecting the system's exceptional uptime and accessibility. Fault Tolerance and Recoverability both scored 3.50, rated as "Very Good," suggesting that the system can handle faults and recover from them effectively, though there is room for improvement. The overall average mean for reliability is 4.0, interpreted as "Very

Good." These results demonstrate that Grab Rescue is a highly reliable system, with notable strengths in availability, maturity, and fault tolerance, while still having opportunities for further enhancement in its recoverability.

Security

Indicators	**WM**	**Verbal Interpretation**
Confidentiality	4.0	Very Good
Integrity	4.0	Very Good
Non-repudiation	4.0	Very Good
Accountability	3.50	Very Good
Authencity	4.0	Very Good
Average Mean	3.90	Very Good

Table 4.6 Security Evaluation

Table 4.6 assesses the security evaluation of Grab Rescue, based on ISO 25010 standards, demonstrates strong performance across several security indicators. Confidentiality, Integrity, Non-repudiation, and Authenticity each scored 4.0, all interpreted as "Very Good," reflecting the system's robust protection of data, integrity, and authentication processes. Accountability scored 3.50, rated as "Good," suggesting that while the system provides a reasonable level of

accountability, there is room for improvement. The overall average mean for security is 3.90, interpreted as "Very Good." These results highlight that Grab Rescue excels in maintaining confidentiality, integrity, and authenticity, while offering solid security, with opportunities for enhancement in accountability.

Maintainability

Indicators	**WM**	**Verbal Interpretation**
Modularity	4.0	Very Good
Reusability	3.50	Very Good
Analyzability	3.67	Very Good
Testability	4.0	Very Good
Average Mean	3.80	Very Good

Table 4.7 Maintainability Evaluation

Table 4.7 shows the maintainability evaluation of Grab Rescue, based on ISO 25010 standards, indicates strong performance across various indicators. Modularity, Testability, and Reusability each scored 4.0, interpreted as "Very Good," demonstrating that the system is well-structured, easy to test, and capable of reusing components effectively. Analyzability received a score of 3.67, also rated as "Very Good," reflecting that the system can be analyzed and understood with relative ease. The overall average mean for maintainability is 3.80, interpreted

as "Very Good." These results suggest that Grab Rescue is highly maintainable, with a well-organized structure, effective testing, and reusability, although there is some room for improvement in analyzability.

Portability

Indicators	**WM**	**Verbal Interpretation**
Adaptability	4.0	Very Good
Installability	5	Excellent
Replaceability	3.50	Very Good
Average Mean	4.16	Very Good

Table 4.8 Portability Evaluation

Table 4.8 shows the portability evaluation of Grab Rescue, based on ISO 25010 standards, shows strong performance across the relevant indicators. Adaptability scored 4.0, interpreted as "Very Good," indicating that the system can be easily adapted to different environments. Installability received the highest score of 5, categorized as "Excellent," reflecting the system's ease of installation. Replaceability scored 3.50, rated as "Very Good," suggesting that while the system can be replaced with minimal effort, there is room for improvement. The overall average mean for portability is 4.16, interpreted as "Very Good." These results highlight that Grab Rescue is highly portable, with particular strengths in

installability and adaptability, while offering good replaceability with potential for further enhancement.

Indicators	**WM`**	**Verbal Interpretation**
Functional Suitability	4.07	Very Good
Performance Efficiency	3.83	Very Good
Compatibility	3.75	Very Good
Usability	4.51	Excellent
Reliability	4	Very Good
Security	3.90	Very Good
Maintainability	3.80	Very Good
Portability	4.16	Very Good
Great Mean	4.10	Very Good

Table 4.9 Total Weighted Mean

Figure 4.40 presents the total weighted mean for Grab Rescue across various ISO 25010 indicators. The system performs well in multiple areas, with the highest score in **Usability** at 4.51, categorized as "Excellent," reflecting its strong user-friendly design. **Functional Suitability** scored 4.07, rated as "Very Good," indicating that the system meets the required functionalities effectively. Other areas

like **Reliability**, **Maintainability**, **Portability**, and **Security** all received "Very Good" ratings with scores ranging from 3.75 to 4.16. **Performance Efficiency** scored 3.83, also rated "Very Good," while **Compatibility** received a score of 3.75, further supporting the system's reliable and efficient performance. The overall **Great Mean** for the system is 4.10, which is categorized as "Very Good," indicating that Grab Rescue performs admirably across all evaluated areas, with particularly strong usability.

6. To evaluate the developed application project using Technology Acceptance Model (TAM) for both responders and citizens.

Indicators	F							M	W
1. Perceived Usefulness	7	6	5	4	3	2	1		
a. Using Grab Rescue would help me respond to Emergencies more quickly	13	2						6.86	Extremely Likely
b. Using Grab Rescue would improve my chances of resolving emergencies effectively	12	2	1					6.73	Extremely Likely
c. Using Grab Rescue would make it easier for me to report emergencies	10	4	1					6.6	Extremely Likely

d. Using Grab Rescue would enhance my confidence in managing emergencies	12	3						6.8	Extremely Likely
e. Using Grab Rescue would simplify the process of seeking help in emergencies	13	2						6.86	Extremely Likely
f. I would find Grab Rescue useful in managing emergencies	13	2						6.86	Extremely Likely
Average Mean								**6.78**	**Extremely Likely**

Table 4.10 TAM-Citizen for Percieved Usefulness Indicators

The table presents the perceived usefulness of Grab Rescue based on citizen responses, rated on a 7-point Likert scale. Indicators include its ability to help users respond to emergencies quickly, improve resolution chances, simplify reporting, enhance confidence, and streamline seeking help. Most respondents rated these aspects highly, with average means ranging from 6.6 to 6.86 across indicators, culminating in an overall average mean of 6.78. This suggests that respondents find Grab Rescue extremely useful for managing emergencies effectively.

Indicators	F							M	W
2. Perceived Ease-of-Use	7	6	5	4	3	2	1		
a. Learning to use Grab Rescue would be easy for me	9	6						6.6	Extremely Likely
b. I would find it easy to use Grab Rescue for reporting emergencies or requesting help	12	3						6.8	Extremely Likely
c. My interaction with Grab Rescue would be straightforward	8	7						6.53	Extremely Likely
d. I would find Grab Rescue's interface clear and understandable	12	3						6.8	Extremely Likely
e. It would be easy for me to become skillful at using Grab Rescue	11	4						6.73	Extremely Likely
f. I would find Grab Rescue easy to use	12	3						6.8	Extremely Likely
Average Mean								**6.71**	**Extremely Likely**

Table 4.11 TAM-Citizen for Percieved Ease-of-use Indicators

The table highlights the perceived ease of use of Grab Rescue based on citizen responses, assessed through various indicators using a 7-point Likert scale. Respondents strongly agreed that Grab Rescue is easy to learn and use, with straightforward interactions, a clear interface, and a simple learning curve. The individual mean scores for the indicators range from 6.53 to 6.8, reflecting consistent agreement across all aspects. The overall average mean of 6.71 indicates that respondents find Grab Rescue extremely easy to use.

Indicators	**Mean**	**Description**
Perceived Usefulness	6.78	Extremely Likely
Perceived Ease-of-Use	6.71	Extremely Likely

Table 4.12 TAM-Citizen's Total Weighted Mean

The table presents the overall evaluation of Grab Rescue based on the TAM-Citizen framework, with total weighted means across four key dimensions: Perceived Usefulness (6.78), Perceived Ease-of-Use (6.71). All dimensions received extremely high ratings, indicating that respondents find Grab Rescue highly useful, easy to use, and are very likely to adopt and recommend it. The results reflect a strong overall positive perception of the system's potential for emergency management.

Indicators	F							M	W
1. Perceived Usefulness	7	6	5	4	3	2	1		
a. Using Grab Rescue would help me respond to Emergencies more quickly	4	1						6.8	Extremely Likely
b. Using Grab Rescue would improve my chances of resolving emergencies effectively	4	1						6.8	Extremely Likely
c. Using Grab Rescue would make it easier for me to report emergencies	4	1						6.8	Extremely Likely
d. Using Grab Rescue would enhance my confidence in managing emergencies	4	1						6.8	Extremely Likely
e. Using Grab Rescue would simplify the process of seeking help in emergencies	4	1						6.8	Extremely Likely
f. I would find Grab Rescue useful in managing emergencies	3	2						6.6	Extremely Likely
Average Mean								**6.76**	**Extremely Likely**

Table 4.13 TAM-Rescuers for Perceived Usefulness Indicators

The table evaluates the perceived usefulness of Grab Rescue from the perspective of rescuers, using a 7-point Likert scale. Rescuers rated the system highly across all indicators, such as its ability to improve response time, facilitate reporting, boost confidence, simplify processes, and enhance emergency management. The individual mean scores for most indicators are 6.8, with one at 6.6, demonstrating consistently strong agreement. The overall average mean of 6.76 suggests that rescuers find Grab Rescue extremely useful for handling emergencies efficiently.

Indicators	F							M	W
2. Perceived Ease-of-Use	7	6	5	4	3	2	1		
a. Learning to use Grab Rescue for rescue operations would be straightforward for me	4	1						6.8	Extremely Likely
b. It would be easy or me to manage rescue requests using Grab Rescue	4	1						6.8	Extremely Likely
c. The Interface of Grab Rescue would make it simple to track emergencies	3	2						6.6	Extremely Likely
d. I would find Grab Rescue's interface clear and understandable	4	1						6.8	Extremely Likely

e. It would be easy for me to teach others how to use Grab Rescue	4	1						6.8	Extremely Likely
f. I would find Grab Rescue intuitive and user-friendly for my tasks	4	1						6.8	Extremely Likely
Average Mean								**6.76**	**Extremely Likely**

Table 4.14 TAM-Rescuers for Percieved Ease-of-use Indicators

The table assesses the perceived ease of use of Grab Rescue from the rescuers' perspective, based on a 7-point Likert scale. Rescuers rated the system highly for its straightforward learning process, ease of managing requests, intuitive interface, and user-friendliness. Most indicators received a mean score of 6.8, except for one at 6.6, indicating slight variation but consistently strong agreement. The overall average mean of 6.76 suggests that rescuers find Grab Rescue extremely easy to use and well-suited for rescue operations.

Indicators	**Mean**	**Description**
Perceived Usefulness	6.76	Extremely Likely
Perceived Ease-of-Use	6.76	Extremely Likely

Table 4.15 TAM-Rescuers' Total Weighted Mean

The table presents the overall evaluation of Grab Rescue from the rescuers' perspective using the TAM framework. All dimensions received high ratings, with

Perceived Usefulness and Ease-of-Use both scoring 6.7. These consistently high scores indicate that rescuers find Grab Rescue extremely useful, easy to use, and are highly likely to adopt it while maintaining a positive attitude toward its role in improving emergency management.

Indicators	Mean	Description
Perceived Usefulness	6.77	Extremely Likely
Perceived Ease-of-Use	6.73	Extremely Likely
Great Mean	6.75	Extremely Likely

Table 4.16 TAM Total Weighted Mean

Table 4.16 summarizes the total weighted mean of the Technology Acceptance Model (TAM) evaluation for Grab Rescue. The application received high ratings, with a mean of 6.77 for perceived usefulness and 6.73 for perceived ease of use, resulting in an overall mean of 6.75. These scores indicate that respondents are extremely likely to find the app useful and easy to use.

CHAPTER V

SUMMARY OF FINDINGS, CONCLUSION, AND RECOMMENDATIONS

This chapter shows the summary of the researcher's findings, conclusions they made, and their recommendations.

1. **Summary of Findings**

The following is a summary of the results following an extensive evaluation of all the information gathered and evaluated:

1. This study developed an emergency response web-based mobile application suitable for both desktop and mobile platforms that automates the processes involved in location tracking and the fastest route navigation feature using HTML, CSS, and JAVASCRIPT programming languages. Developers also utilized frameworks of those programming languages, such as NEXT.JS, REACT.JS, EXPRESS, and NODE.JS. The developed web-based mobile application utilized the MAPBOX GL API as the main component of the developed web-based mobile application.
2. Grab Rescue's key characteristics and functionality differ depending on the user role and interface. Citizens can locate the nearest rescuer to the situation, follow their location, fill out an emergency information form, and see the rescuer's details. The rescuer side can also perform location tracking and position monitoring, navigate the fastest route to an emergency location, perform emergency information verification based on the emergency information form the citizens filled out, and perform emergency request confirmation. To ensure effective cooperation during emergencies,

the administrator can monitor real-time system activity, manage rescuers' accounts, and generate reports using the desktop interface.

3. The logic behind the development of the Grab Rescue process of handling the emergency request is based on the data that the researchers gathered during the several interviews that were conducted with the rescuers; it includes the current emergency process handling and recommendations of what is a more efficient thing to do when emergency assistance is needed.
4. The findings reveal that the system, evaluated based on ISO standards by IT experts, demonstrated strong overall performance with a general weighted mean of 4.10, verbally interpreted as "Very Good." Among the quality attributes, Usability achieved the highest rating of 4.51, categorized as "Excellent," signifying that the system is highly user-friendly and efficient. Portability also received a notable rating of 4.16, indicating its capability to function effectively across different platforms. Other key indicators, such as Functional Suitability, Reliability, and Security, were rated "Very Good," reflecting the system's ability to meet functional requirements, maintain reliability, and ensure robust security. These results indicate that the system is well designed and consistently performs well across all assessed quality attributes.
5. The findings of the study revealed that the Grab Rescue application was highly rated by both citizens and responders in terms of perceived usefulness and ease of use, based on the Technology Acceptance Model

(TAM), where the highest possible score is 7, which is equivalent to "Extremely Likely." Prior to conducting the assessment, coordination with the Office of the Mayor was established to secure permission to evaluate key agencies, including the MDRRMO, PNP, and BFP. The results showed that citizens found the application extremely useful, with an average mean score of 6.78, which is also equivalent to "Extremely Likely," and easy to use, with an average mean of 6.71, which is also equivalent to "Extremely Likely." Similarly, rescuers provided high ratings, with both perceived usefulness and ease of use achieving an average mean score of 6.76, also equivalent to "Extremely Likely." According to TAM interpretation, these high ratings indicate that both citizens and rescuers find the application highly beneficial and user-friendly, which suggests a strong likelihood of future adoption. Respondents emphasized that the app is expected to significantly improve their ability to report and respond to emergencies, enhance their confidence in managing critical situations, and simplify the process of seeking help. These findings suggest that Grab Rescue will be an effective tool for enhancing emergency response and management within the municipality.

2. **Conclusions**

After the study was completed, demonstrated, and tested, the researchers concluded that all objectives in Grab Rescue: Empowering Emergency Response with GPS-Driven Rescue Management were successfully met.

With the information and evaluations gathered in cooperation with the Municipality of San Rafael, along with the PNP, BFP, and MDRRMO of San Rafael, it can be concluded that the Grab Rescue application effectively addresses key challenges in current emergency response systems. By integrating real-time GPS tracking, intuitive user interfaces, and streamlined workflows, the application provides a faster, more reliable, and user-friendly platform for managing emergencies. It ensures that citizens receive timely assistance while enabling rescuers to operate efficiently.

The study concludes that Grab Rescue meets the needs of both rescuers and citizens during emergencies, offering significant improvement over traditional response methods.

1. The design and development of the web-based mobile application were developed with the functional requirements in mind.
2. Users of Android devices can now download the web-based mobile application as an APK file and will be available in Google Play Store once the application is approved. It can be accessed through a link for iOS users using internet browsers, but for optimal performance, Google Chrome is the suggested browser.

3. Based on the TAM (Technology Acceptance Model) results, the developed web-based mobile application successfully met the requirements and expectations of the rescuers and citizens in the Municipality of San Rafael. The positive reception highlights the application's ease of use, perceived usefulness, and its ability to enhance emergency response processes effectively.
4. 4. The ISO 25010 evaluation results demonstrate that the IT experts who assessed Grab Rescue validated its performance in key quality attributes, such as functionality, usability, and reliability. The application was found to be robust and intuitive, providing an efficient platform for both citizens and rescuers to coordinate during emergencies.

3. **Recommendations**

The findings and conclusions drawn by the researchers, incorporating feedback from trained rescuers and citizens, have led to the following recommendations. These suggestions aim to further enhance the **Grab Rescue** system and its effectiveness in emergency response. Additionally, they serve as guidance for future researchers and developers who may undertake similar projects, ensuring continual improvement and innovation in this critical field.

1. Implement offline usage so that users can use it without the internet.
2. Implement real-time messaging and calling protocols through the web-based mobile application.
3. Improve accessibility features for people with disabilities.

4. Include automated text to guardians or relatives for quick awareness.

5. The Philippine National Police (PNP) has advised citizens to avoid accessing or sharing the location of rescuers during emergency operations to ensure their safety. This precaution aims to prevent disruptions, interference, or accidents that could jeopardize the safety of both rescue teams and affected individuals.