

A Personal Health Monitoring and Emergency Assistance Mobile Application

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Abstract — *As digital technology continues to advance; new opportunities arise for enhancing emergency response and health management. The Be Safe mobile application focuses on identifying these opportunities and leveraging today's AI capabilities to improve the efficiency and effectiveness of emergency services. By utilizing Dart, FlutterFlow, Firebase, and OpenAI's ChatGPT, the app enables users to store and monitor vital health data, record and upload emergency videos, and receive real-time AI-driven guidance. The primary goal of the project is to optimize emergency response in Puerto Rico by providing accurate information to first responders, ultimately saving time and resources. With the integration of advanced AI-driven communication features and personalized content generation, Be Safe aims to be a powerful tool for both individuals and first responders in managing health and ensuring safety during emergencies.*

Key Terms — *Be Emergency Response, Health Management, AI-driven Communication, Personalized Content, Opportunities.*

INTRODUCTION

The increasing reliance on technology has revealed numerous opportunities to improve emergency response and health management, particularly in the context of handling emergency calls in Puerto Rico. According to the Puerto Rico Emergency Management and Disaster Administration Agency, more than 1.3 million emergency calls were made to the 911 system in 2019. Unfortunately, approximately 40% of these calls were considered false alarms or non-emergency situations, leading to increased response times and inefficient use of resources (EMDACPR, 2019) [1].

The Be Safe mobile application aims to address these challenges by leveraging cutting-edge AI capabilities and digital tools to optimize emergency response services and provide users with real-time assistance during critical situations. By providing accurate information to first responders, the Be Safe app can help reduce the response times, which, according to the American Heart Association, is crucial as the chances of survival for cardiac arrest victims decrease by 7-10% with every minute delay in defibrillation.

In Puerto Rico, emergency calls to 911 often face issues related to response times and the allocation of appropriate resources. As a result, there is a growing need to develop solutions that can streamline the process and provide accurate information to first responders, ensuring that they are well-equipped to handle emergencies effectively. With the integration of advanced AI-driven communication features and personalized content generation, Be Safe aims to be a powerful tool for both individuals and first responders in managing health and ensuring safety during emergencies.

The Be Safe mobile application focuses on addressing these challenges by leveraging today's AI capabilities to enhance emergency response services and provide real-time guidance to users during emergencies. By utilizing Dart, FlutterFlow, Firebase, and OpenAI's ChatGPT, the app enables users to store and monitor vital health data, record and upload emergency videos, and receive real-time AI-driven guidance. The primary goal of the project is to optimize emergency response in Puerto Rico by providing accurate information to first responders, ultimately saving time and resources.

As the integration of technology and emergency response services continues to grow, the Be Safe mobile application seeks to capitalize on

these advancements to provide a comprehensive solution for both individuals and first responders, helping to ensure the safety and well-being of those in need during critical situations.

BACKGROUND

In Puerto Rico, emergency response systems face unique challenges due to the region's geographical and infrastructural factors. The island's topography, combined with its susceptibility to natural disasters such as hurricanes and earthquakes, highlights the need for an efficient and reliable emergency response system. Furthermore, in a study conducted by the Puerto Rico Institute of Statistics, it was revealed that the average response time for emergency medical services (EMS) in the region was 15.2 minutes in 2018, significantly higher than the recommended 8-minute response time for urban areas (PRIS, 2018) [2].

These challenges have led to the recognition of the potential for technology and artificial intelligence to improve emergency response services. By integrating AI-driven features and digital tools, the Be Safe mobile application seeks to enhance the efficiency of emergency response and empower individuals to manage their health proactively. The app allows users to store and monitor vital health data, record and upload emergency videos, and receive real-time AI-driven guidance during emergencies.

The Be Safe app aims to address the inefficiencies in resource allocation and information accuracy in emergency response services, particularly in Puerto Rico. By providing first responders with accurate information and enabling users to record and upload videos of emergencies, the app helps in dispatching the appropriate emergency response teams, saving time and resources. In addition, the app offers users an AI-driven experience to assist in managing their health, promoting overall well-being and safety.

As technology and AI continue to advance, there is an increasing need to develop solutions that

can address the challenges faced by the emergency sector. The Be Safe mobile application focuses on leveraging today's AI capabilities and digital tools to optimize emergency response services and provide real-time assistance to users during emergencies. With Dart, FlutterFlow, Firebase, and OpenAI's ChatGPT integration, the app aims to offer a user-friendly and accessible platform for improved emergency response and health management in everyday life.

PROBLEM

As mentioned earlier, emergency response systems in Puerto Rico face several challenges, including inefficiencies in resource allocation and a lack of accurate information. These issues often lead to delays in assistance and the deployment of unnecessary resources, ultimately resulting in wasted time and money. The Be Safe mobile application aims to address these challenges by providing a comprehensive solution that empowers individuals to manage their health and optimize emergency response services.

A study by Rivera-Santana et al. (2016) highlighted the need for improvements in pre-hospital care in Puerto Rico, including better communication between EMS and receiving hospitals and enhanced training for emergency medical technicians [3].

The Be Safe app seeks to solve these problems by enabling users to record and upload videos of emergencies, providing first responders with valuable information to accurately assess the situation and dispatch the correct team. Additionally, the app empowers users to manage their health more effectively by providing AI-driven guidance and personalized content. By addressing these challenges, the Be Safe mobile application aims to save time, resources, and potentially lives during emergency situations in Puerto Rico.

METHODOLOGY

To develop the Be Safe mobile application and optimize its features, we will follow a multi-step process:

1. Assess the current emergency response system in Puerto Rico: This involves analyzing response times, resource allocation, communication between emergency service providers, and other key factors that affect the efficiency of emergency response.
2. Identify opportunities for improvement: Based on the assessment, we will pinpoint specific areas where the Be Safe app can offer valuable support, such as facilitating communication between emergency responders and improving the allocation of resources.
3. Develop the AI-driven platform: The Be Safe app will use AI technologies to enable users to record and upload videos of emergencies and receive personalized health guidance. The app will also analyze user data to improve the overall emergency response system.
4. Conduct user testing: To ensure the app meets the needs of users and effectively addresses the challenges identified in the assessment, we will engage in extensive user testing and gather feedback on the app's features and functionality.
5. Refine the app based on feedback: Using the insights gained from user testing, we will make improvements to the app's design, features, and functionality to maximize its impact on the emergency response system in Puerto Rico.

ANALYSIS

In order to gain a better understanding of the current emergency response system in Puerto Rico and to identify opportunities for improvement, we conducted an interview with an expert in the field. Our interviewee has 12 years of experience as a first responder, working both in ambulances and local emergency management offices. Their insights provided valuable context for our analysis and helped us to identify key areas where the Be Safe app could potentially enhance the existing system.

During our interview, our expert emphasized the importance of reducing the time it takes for 911 to transmit calls to local offices, as well as the time it takes for these offices to assign appropriate providers to each case. They also highlighted the potential benefits of providing emergency agents with real-time video footage of emergency situations, as this could help them to more accurately assess the severity of each case and allocate resources more efficiently.

Based on these insights, we decided to analyze real emergency response data to evaluate the current system and determine how the Be Safe app could potentially improve emergency response times and overall efficiency. The following Data Analysis and Results section presents our findings and discusses the potential impact of the Be Safe app on the emergency response system in Puerto Rico.

Table 1
Time to Transmit an Emergency

Case	Date	Emergency	Time to transmit to Local Office	Time to Assign a Provider
1	5/8/23	Respiratory Distress	1:04	0:04
2	5/8/23	Car Crash	3:09	1:20
3	5/7/23	Bleeding from a leg	2:02	0:46
4	5/5/23	Urinal bleeding	3:07	8:42
5	5/3/23	Nervous breakdown	1:33	3:00

UNDERSTANDING THE CURRENT SYSTEM: SKYCAD

As part of our research, we obtained supervised access to SkyCAD, a computer-aided dispatch system currently used to manage emergency calls in Puerto Rico. This was facilitated by our expert interviewee, who provided guidance and context to understand its features and functions. Our aim was to identify the strengths and weaknesses of the existing system and draw parallels to our proposed solution, the Be Safe app.

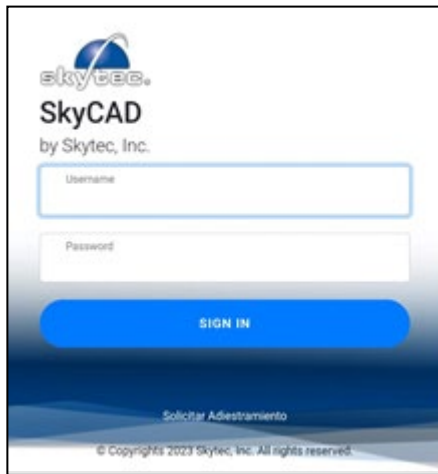


Figure 1
SkyCAD

SkyCAD, developed by SkyTec, is a robust solution for handling emergency calls, from receiving and dispatching to tracking and reporting. It includes a user interface with several components that emergency service providers use to manage incoming calls, allocate resources, and monitor the status of emergency responses in real-time.

We carefully observed how SkyCAD calculates response times, as our primary focus with the Be Safe app is to reduce these times and

increase the efficiency of emergency responses. We noticed that there are certain areas in the process, such as transmitting the call from 911 to the nearest local office and assigning a provider, where delays could occur.

We captured screenshots of the SkyCAD interface and its response time calculation for reference, to provide a visual contrast to our Be Safe app interface and processes. These visuals will be presented in the following sections.

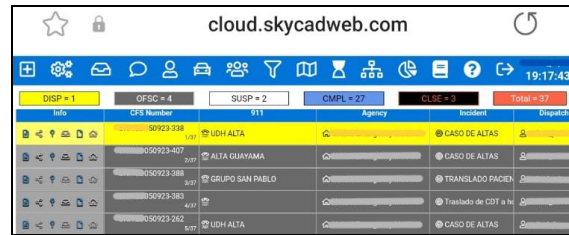


Figure 2
SkyCAD Dashboard

RESULTS AND DISCUSSION

We conducted an analysis of five real emergency cases to evaluate the current emergency response system in Puerto Rico and identify potential areas of improvement. We focused on the time it takes for a 911 call to be transmitted to the nearest local office and the time it takes for the office to assign a provider to the case.

Findings

Our analysis indicates that the time to transmit an emergency from 911 to the nearest local office and the time to assign a provider vary significantly across cases. These highlights potential inefficiencies in the current system and suggests that there is room for improvement.

Horas		Tiempos	
Creado 9-1-1:	2023-05-08 01:17:32	9-1-1:	0:01:54
Recibido 9-1-1:	2023-05-08 01:19:25	Activacion:	0:03:09
Recibido en Despacho:	2023-05-08 01:19:26	Reaccion:	0:03:09
Activado:	2023-05-08 01:20:45	Ruta:	0:09:26
Escena:	2023-05-08 01:35:11	En Escena:	0:21:41
Completado:	2023-05-08 02:52:37	Ruta Hospital:	0:21:41
Archivado:		En Hospital:	0:30:01
		Total Agencia: 1:33:10 Total Llamada: 1:35:05	

Figure 3
SkyCAD Part of Generated Case PDF

Potential Impact of the Be Safe App

Based on the collected data and insights from our interview with an experienced first responder, we believe that the Be Safe app has the potential to improve emergency response times and efficiency in several ways:

- Reducing the transmission time from 911 to the nearest local office: By automatically determining the user's location and uploading the video and relevant information to the nearest local emergency office, the Be Safe app could significantly reduce the time it takes for 911 to transmit the emergency to the local office.
- Facilitating faster provider assignment: Providing emergency agents with a video of the emergency scenario allows them to quickly assess the situation and assign an appropriate provider based on the observed details, such as the severity of injuries, the number of people involved, and other relevant factors. This could potentially reduce the time needed to assign a provider and ensure that the most appropriate resources are allocated to each emergency.
- Improving overall emergency response efficiency: By streamlining communication between users, emergency service providers, and local emergency offices, the Be Safe app could help to optimize resource allocation and ensure that help is provided more quickly and effectively in emergency situations.

By comparing the current system, SkyCAD, with our proposed solution, the Be Safe app, we're able to highlight the innovative features and improvements our app offers. It is important to remember that this comparison is not intended to undermine the effectiveness of SkyCAD, but rather to illustrate how technology can continually evolve and enhance emergency response management.

In conclusion, our data analysis and results suggest that the Be Safe app has the potential to significantly improve the efficiency of emergency response in Puerto Rico. Further research and user testing will be necessary to confirm these findings

and refine the app's features to maximize its impact on the emergency response system.

TOOLS AND TECHNOLOGIES

FlutterFlow is a powerful and user-friendly app development platform that helps to reduce development time by providing pre-created widgets and a visual interface for designing and building applications. FlutterFlow simplifies the development process by generating code automatically for the app's user interface, using the Flutter framework. This allows developers to focus on other aspects of the project while ensuring a responsive and visually appealing application [4].



Figure 4
Flutter Flow

In addition to pre-built widgets, FlutterFlow also allows developers to create custom widgets and integrate them into the application. This feature provides more flexibility and control over the app's design and functionality, ensuring that unique requirements can be met. Furthermore, FlutterFlow supports the creation of custom functions, enabling developers to define specific behaviors and interactions tailored to the app's needs.

By leveraging FlutterFlow's capabilities, including its support for custom widgets and functions, we were able to quickly create the user interface, implement the app's features, and address any specific requirements unique to the Be Safe app.

Firebase is a powerful and versatile backend-as-a-service (BaaS) platform by Google that provides a suite of tools for app development and management, including Firestore, Authentication, Real-time Database, and Cloud Messaging [5]. Firebase offers a scalable and robust infrastructure, which enables us to build and manage the Be Safe app efficiently.



Figure 5
Firebase

Firestore is a flexible, scalable NoSQL cloud database that allows us to store and sync app data in real-time. In the Be Safe app, Firestore serves as the main database, enabling us to store user data, emergency videos, and other relevant information. The real-time capabilities of Firestore ensure that any changes made to the data are immediately reflected in the app, enhancing the overall user experience.

Firebase Authentication offers a variety of sign-in methods, such as email/password, social media logins, and phone number authentication. In the Be Safe app, we use Firebase Authentication to securely manage user sign-ins and access control, ensuring that only authenticated users can access their data and interact with the app.

Notifications: Firebase Cloud Messaging (FCM) is a service that allows us to send targeted notifications and messages to users of the Be Safe app. With FCM, we can send alerts, reminders, or other important information to users, keeping them informed and engaged with the app.

Cloud Functions: Firebase Cloud Functions enable us to write and deploy serverless functions that are triggered by events in our app, such as a new video being uploaded, user registration, or changes to the database. In the Be Safe app, we can utilize Cloud Functions to integrate with ChatGPT, send notifications, or automate other tasks, such as determining the nearest emergency office based on user location.

By utilizing these Firebase services, we can efficiently build, manage, and scale the Be Safe app, ensuring a secure, responsive, and feature-rich experience for users.

In the Be Safe app, we incorporate OpenAI's ChatGPT, Text-to-Speech (TTS), and Speech-to-Text (STT) technologies to facilitate efficient and accurate communication between users and the app,

as well as to provide personalized assistance during emergencies.



Figure 6
Open AI

ChatGPT is a state-of-the-art natural language processing model developed by OpenAI that excels at generating human-like text based on a given input [6]. In the Be Safe app, we use ChatGPT to offer a virtual assistant that understands and responds to user queries in natural language. This enables users to receive contextually relevant information and assistance during emergencies, such as first aid advice, guidance on contacting emergency services, and other crucial support.

Text-to-Speech (TTS): TTS is a technology that converts written text into spoken words, allowing users to receive information audibly rather than reading it on the screen. We incorporate TTS into the Be Safe app by using the Flutter Text-to-Speech (`flutter_tts`) package, which supports multiple languages, voices, and speech rates. By implementing TTS, we aim to improve the accessibility of the app and cater to users who may have difficulty reading text or prefer to receive information audibly [7].

Speech-to-Text (STT): STT is a technology that translates spoken language into written text, enabling users to interact with the app using their voice. In the Be Safe app, we implement STT using the Speech-to-Text (`speech_to_text`) package for Flutter, which supports various languages and offers real-time speech recognition. Integrating STT allows users to communicate with the app more efficiently and hands-free, which is particularly valuable in emergency situations where using a keyboard might not be practical [8].

By integrating ChatGPT, TTS, and STT technologies into the Be Safe app, we aim to create a seamless and efficient communication experience that caters to a diverse range of user needs, preferences, and abilities. These technologies work

together to provide an intuitive and accessible interface, enabling users to receive personalized assistance and information during emergencies.

MAIN IMPLEMENTATIONS

The Be Safe mobile application encompasses multiple pages designed to facilitate an efficient and user-friendly experience. It includes the Home Screen, which serves as the application's main hub, providing quick and easy access to various features such as the Patient Record and Profile pages. These pages are integral parts of the application, offering personalized user data and a range of options to navigate through the app effectively.

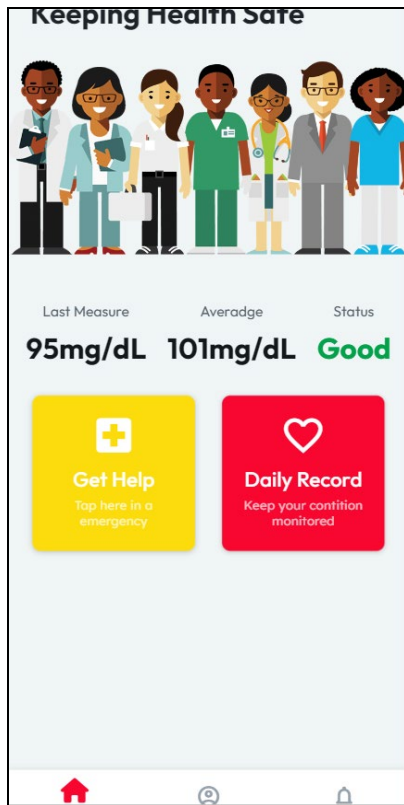


Figure 7
Be Safe Home Page

However, the cornerstone of our project lies within the Emergency Call User Interface (UI). Given its critical role in emergency situations, we have devoted a significant portion of our efforts towards the development and refinement of this UI. This focus is due to the immediate impact it can have on a user's ability to report emergencies,

capture necessary visual evidence, and efficiently communicate with emergency service providers.

In the following sections, we will delve into the intricate details of this specific UI, its various functionalities, and its interoperability with the underlying technologies such as Firebase and ChatGPT. We'll present the methodologies used in its development, the challenges encountered, and how we've overcome them to ensure the Be Safe app can potentially transform emergency response management in Puerto Rico.

It's worth noting that while we focus on the Emergency Call UI for the purpose of this report, the other features of the app contribute to its overall functionality and value proposition. They serve as a foundation for the seamless integration and operation of the Emergency Call feature, creating a comprehensive emergency response solution.

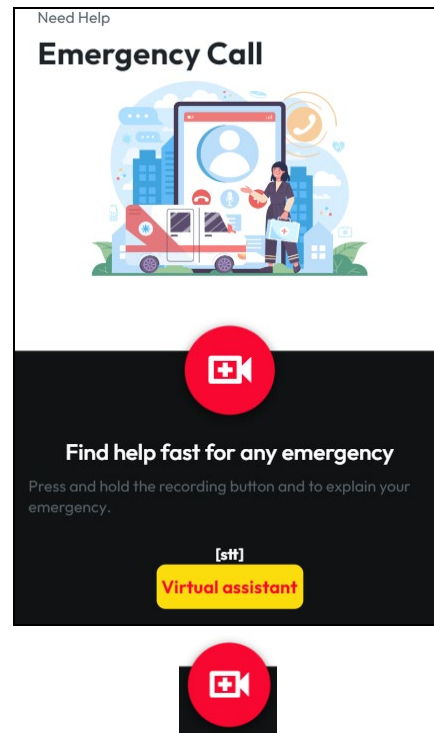


Figure 8
Emergency Call UI

The Recording Button

The Be Safe mobile application leverages the power of real-time video recording and sharing to assist in emergencies. The following code segment demonstrates how the app enables users to record

and upload videos instantly, as well as send relevant information to emergency responders:

1. Long-press event handler: The “onLongPress” event is triggered when the user long-presses the button on the app's interface. This initiates the video recording and sharing process.
2. Get the user's location: The app retrieves the user's current location using the “getCurrentUserLocation” function, which returns a “LatLng” object representing the user's latitude and longitude.
3. Record the video: The “recordVideo” function is called to start recording a new video using the device's camera. The video recording will stop automatically after a predetermined duration or when the user manually stops the recording.
4. Upload the video: The “uploadData” function is used to upload the recorded video to a remote server. The video's download URL is stored in the “downloadUrls” list, which is later used to share the video with emergency responders.
5. Update the UI: The user interface is updated to reflect the new video upload status, as well as any errors that may have occurred during the process.
6. Store emergency call information: The “emergencyCalsCreateData1” and “emergencyCalsCreateData2” objects are created to store the relevant emergency call data, such as the video URL and the user's location. These objects are then used to create a new “EmergencyCalsRecord” document, which is saved to the app's database.
7. Create a video call button: The “child” property of the “onLongPress” event handler contains a container that displays a video call button on the app's interface. When this button is pressed, the video recording and sharing process is initiated.

This implementation ensures that users can only share real-time video footage recorded at the moment, providing valuable and up-to-date

information to emergency responders, helping to improve response times and outcomes in critical situations.



Figure 9
Virtual Assistant Button

The Virtual Assistant Button

The Be Safe mobile application incorporates speech-to-text and text-to-speech functionality, allowing users to communicate with a virtual assistant using voice commands. This is achieved through the use of the “speech_to_text” and “flutter_tts” packages, as well as the custom functions provided by the app. The following steps detail the implementation process:

1. Display text transcription: The “Text” widget is used to display the transcribed speech from the user. The text is styled using the “FlutterFlowTheme” and is updated dynamically as the user speaks.
2. Virtual Assistant button: The ‘FFButtonWidget’ is used to create a button with the label “Virtual assistant.” When this button is pressed, the following actions are triggered:
 - a. Speech-to-text conversion: The “actions.speechToText()” function is called, which records the user's voice and converts it into text using the “speech_to_text” package.
 - b. Send text to GPT API: After a short delay, the transcribed text is sent to the Chat GPT API using the “ChatGPTCall.call()” function. The JSON data from the API response is stored in the “_model.chatResponse” object.
 - c. Check for a successful response: If the API call is successful, the app retrieves the assistant's response from the JSON data and stores it in the “FFAppState().tts” variable.
 - d. Text-to-speech conversion: The “actions.talkToMe()” function is called,

which uses the “flutter_tts” package to convert the assistant's response into speech, playing it back to the user.

3. Update the UI: The user interface is updated to reflect any changes to the transcribed text, the assistant's response, and the button's state.

By integrating speech-to-text and text-to-speech functionality, the Be Safe app provides users with a seamless and efficient way to communicate with a virtual assistant during emergencies, potentially saving valuable time and improving outcomes.

USE CASE

Here's a use case scenario presented in the figure 10 for the Be Safe app, demonstrating the process when a user has an emergency and presses the “Record Video” button:

1. The user encounters an emergency situation (e.g., they have broken their leg, exposing the bone and causing severe bleeding).
2. At the Emergency Call UI of the Be Safe app the user presses the "Record Video" button.

3. The app records the video and uploads it to Firebase, along with the user's data and location.
4. A Firebase function is triggered that identifies the nearest emergency office based on the user's location.
5. The Firebase function sends the emergency video to the identified emergency office.
6. An emergency handler agent at the office views the video and assesses the situation.
7. The agent identifies the type of emergency (e.g., severe leg injury) and assigns a provider to respond.
8. The agent also fills out an observation report based on the video, including details such as exposed bone, right leg, and severe bleeding.
9. The assigned provider receives the emergency request and the observation report, giving them a clear understanding of the user's needs and allowing them to prepare accordingly.
10. The provider reaches the user's location and provides the necessary assistance.

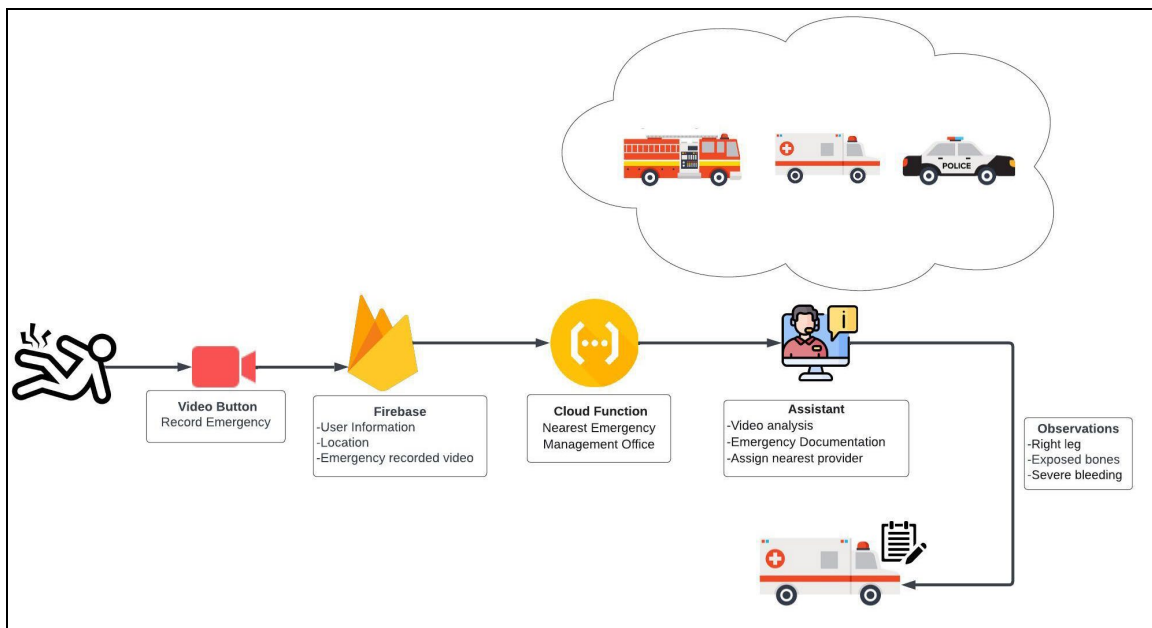


Figure 10
Use Case, Patient Press the Recording Button

COMPETITIVE ANALYSIS

In order to fully understand the advantages of the Be Safe App, it is essential to compare its features with those of its competitors. Two well-known competitors in the emergency response and personal safety market are RapidSOS and Life360. The table 2 presents a comparison of key features between the Be Safe App, RapidSOS, and Life360.

The Be Safe App stands out from its competitors due to its unique features such as real-time video recording, speech-to-text, and text-to-speech capabilities. These features enhance the user experience and provide a more comprehensive approach to emergency situations. Although RapidSOS and Life360 offer integration with 911 and location sharing, they do not provide the same level of multimedia interaction and accessibility as the Be Safe App. This competitive analysis demonstrates the innovative approach and value proposition of the Be Safe App in the emergency response and personal safety market.

Table 2
Identified Related Apps

Feature	BeSafe	RapidSOS	Life360
Real-time video recording	Yes	No	No
Speech-to-text	Yes	No	No
Text-to-speech	Yes	No	No
Integration with 911	Yes	Yes	Yes
Location sharing	Yes	Yes	Yes
User-friendly interface	Yes	Yes	Yes

FUTURE WORK

As technology advances and the capabilities of AI-driven services like ChatGPT continue to evolve, there are numerous opportunities for enhancing the Be Safe app in future updates. One significant enhancement could involve the deeper integration of ChatGPT into the application using Firebase Functions, allowing for a more

personalized user experience based on individual medical conditions and needs.

By leveraging Firebase Functions, the Be Safe app can dynamically connect with ChatGPT to provide tailored content and recommendations for users depending on their specific medical conditions, allergies, or other health-related concerns. This would not only improve the app's overall usefulness but also help users receive accurate and relevant information during an emergency.

To implement this, the app could be further developed to include a comprehensive user profile system where users can input their medical history, conditions, and other pertinent information. Then, Firebase Functions can be used to interact with the ChatGPT API, allowing the app to access contextually relevant information and provide personalized guidance in response to user input.

For example, if a user suffers from a specific medical condition such as diabetes, the app could provide customized advice on managing blood sugar levels during an emergency, in addition to the general emergency response recommendations.

Such enhancements would not only improve the user experience and usefulness of the Be Safe app but also demonstrate the potential for AI-driven services like ChatGPT to be utilized in more personalized and context-specific ways, further revolutionizing the field of emergency response and personal safety applications.

CONCLUSION

The Be Safe mobile application represents a significant advancement in the realm of emergency response management. Harnessing the potential of modern technology, including FlutterFlow, Firebase, and OpenAI's ChatGPT, this innovative solution is poised to redefine emergency response experiences for the citizens of Puerto Rico.

Be Safe stands out with its unique and thoughtful features, such as real-time video recording and sharing, speech-to-text and text-to-speech functionality, and the integration of a virtual

assistant. These features not only enhance user experience during critical moments but also provide responders with comprehensive and real-time information, thereby improving response times and potentially saving lives.

While the existing version of the Be Safe app represents a significant milestone, we are continuously striving to enhance its capabilities and features in order to provide an even better user experience. Our future roadmap for Be Safe is marked with continuous improvements and advancements. This includes rigorous user testing to ensure optimal functionality, forming strategic alliances with emergency services to facilitate seamless cooperation, and expanding our reach to new regions for broader impact.

Moreover, we aim to stay at the forefront of technological advancements, integrating emerging technologies for enhanced user experience and capabilities. A significant enhancement on our radar is the incorporation of AI-driven personal health data analysis. This would allow us to provide users with bespoke advice during emergencies, tailored to their unique health conditions and needs. The future of Be Safe is one of constant evolution and innovation, driven by our unwavering commitment to improving emergency response outcomes.

In essence, the Be Safe app is more than just an application; it's a life-saving tool powered by cutting-edge technology. It's an embodiment of the power of technological innovation to address real-world challenges and enhance the quality of life.

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