

SAFE: Smart Application for Emergency

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Abstract

Emergencies happen at an unexpected time and usually requires immediate action. SAFE is a mobile application for Android phones that aims to be a tool that the community can use when reporting an accident that needs medical attention. Medical responders will also be using this application but will be registered on the rescuer side of the application. The application will have features like the navigation system and the chat support that the users can use for faster relay of information and communication. This will benefit both the hospital and the patient in terms of the emergency responders quickly providing medical attention to the situation, patients are easily located by the medical emergency responders because of the GPS provided, and efficiency in time which is critical in terms of emergency response.

Keywords

Ambulance Sharing System, Life-Saving System, Location Tracking, Accident Detection, and Interactive Chat

1. Introduction

Accidents are an event which humans cannot evade. In a variety of accidents one type of accident is the road accident, which occurs when a vehicle collides with another vehicle, pedestrian, animal, road debris, or other stationary obstruction. Metropolitan Manila Accidents Reporting and Analysis System (MMARAS) reported that 109,322 accidents happened from January - December 2016. These resulted in 426 fatality accidents, 16,416 nonfatal, and 92,480 incidents of damage to properties. In today's world there is no application or system invented to avert accidents. Most of the time the life of the victim depends upon the mercy of other people. In the meantime, the victim left his/her last breath, because the victim cannot reach the hospital timely. The researchers are trying to solve this problem. A system using Internet of Things (IoT) by which a witness will report an accident that happened. Nearest rescue team will also be notified through the application with location from where the accident occurred. By giving the right procedures on applying the first aid to the injured or ill person from the accident may prolong his/her chances of survival while waiting for the rescue or ambulance. The succeeding chapters will tackle the state of the Philippines when it comes to its preparedness and rapid response on accidents.

1.1 Objectives

General Objectives

The researchers aim to create and develop a smart application for emergencies that people could use for medical emergencies, and they need medical responders on the scene of the incident.

Specific Objectives

Below are some key features of the application that users can find helpful when using the application.

Interactive Chat Support

To provide better communication between the witness or the person who asks for a rescue and the responder.

Live Location Sharing

To be able to share location of both the rescuers and the victim for easier planning of rescue and transfer to the hospital.

User Accounts

To identify the user who reported an incident and register them in the system.

2. Literature Review

2.1 Designing Mobile Applications for Emergency Response: Citizens Acting as Human Sensors

The citizens are playing a big role when emergencies come up in a conversation or a scenario. The people become witnesses who will be doing a major task or big responsibility in saving the victim. As witnesses, to an accident, they initially can share updated and detailed information about what is going on.

Nowadays, with the innovated technologies showing up in the markets, people are learning to adjust to it. With that situation happening, the people are also learning how to gather data quickly, where this data holds significant information that can be transmitted on different communication channels like social media platforms. These mobile devices can provide the people different applications which can be called sensors like the GPS, Wi-Fi, cameras, etc., which can make and turn the person into a human sensor. The study aims to discover multiple findings on how to plan, design, organize effective and maximized efficiency mobile emergency notification applications.

Multiple tests are executed and evaluated to see the events happening in the software. Emergencies from a small-scale up to the big-scale ones are tested for the software. Other technicalities are also identified for the reports which are like the kind of interaction, the functions, and the content of the message that one can share. Some applications were also used as their motivations to create the study, some of the applications are the SafetyGPS, HelpBridge, MotorolaAlert, and the EmergencyAlert. The content and the interaction are the key functions that the researchers are noticing as the major component to making the software be usable to a lot of people. For the content, the software must be able to respond to the report immediately and retrieve the needed information from it. Interaction must be greatly focused on usability and its design must be simple and easy enough to be understood and used by many.

The study was evaluated in two experiments. One is performed in a controlled environment where the goal is to identify the possible usability issues in the software and the other is in a simulated environment which aims to analyze the behaviors done by the users. Both experiments showed different but meaningful results, the response time of the software was one of the results that the researchers were looking for as it could give them a result for the software's efficiency. They also collected data on the user's errors, keywords on the reports, and software response when multimedia reports are sent.

According to the study's feedback, a lot of potential users will also be using it. This note shows that many people are also looking forward to this kind of application and this shows that the potential users are convinced that it could benefit them a lot and be used when needed. When emergencies happen, we see that this kind of software can be a go-to for a person to help him/her for the current situation happening. This can become another type of medium that the people can use when emergencies happen, and they want to report and at the same time help the victim.

With relation to SAFE, both applications are for medical emergency response. Both can navigate and locate the reported emergency and has their built-in chat supports. SAFE can also provide the things that the incident reporter can do while waiting for the emergency responders. Applications like this are a big help for the people to get help in times of need and it could also help save the life of the victim.

2.1.2 Emergency Response System: Research Directions and Current Challenges

A research conducted by Shahrah and Al-Mashari, stated that there are different research directions to support emergency response systems (ERs) as shown in Figure 1.

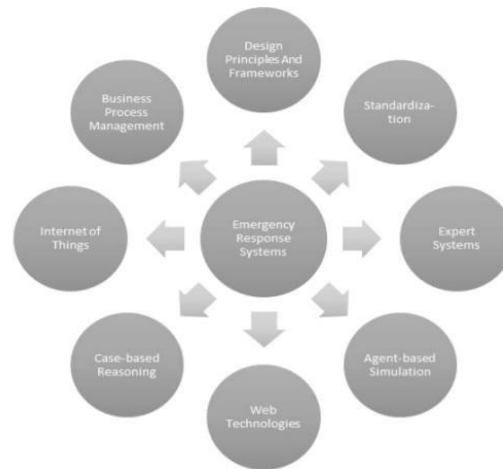


Figure 1. Research directions related to ERSs

As stated in the article, the objective of an emergency response systems (ERS) is to have an in-between communication during the process of emergency response. In today's technology leaning to internet of things (IoT), the common emergency response systems are not flexible, designs are not well established or coded, takes a long time to process for the emergency to response; thus, failing to response quickly and failing to adjust to the rapid change of the new requirements and technology. Therefore, ERSs must be scalable, flexible, and adaptable.

Some of the current challenges that the ERS faces are the following: For the next generation design principles and frameworks needs new design. In-depth research for the perceptive response system, because specious is an issue for the emergency response systems.

The responders or rescue units plays a major role in emergency response system, having a flexible response team means they can perform well in different scenarios. With the inclination of technology to Internet of Things (IoT), the privacy and response time plays a major role in emergency response system.

This study helps future researchers on the development for the Emergency Response Systems (ERS) to enhance the impact on public safety and emergency management and for the systems to be flexible for new technologies.

2.1.3 Design and Development of a Smartphone-based Application to Save Lives during Accidents and Emergencies

Many people are in danger because of road accidents. Road accidents involve crashes that lead to minor or major injuries or death. This article proposes to develop a smartphone application called *LifeSaver* as an emergency response aid to detect accidents.

LifeSaver is a smartphone-based mobile application developed using Android Studio, which is a standalone app that gathers data from the user's smartphone sensors. After the application analyses the data of the user, actions will begin. The user receives proper medical treatment after an accident. It helps prevent accidents using warning and alerts. The basic feature of the application is to alert the ambulance services through service numbers via SMS. The SMS sent to emergency medical services (EMS) is a formatted message that will figure out the accident's location. SOS alerts are sent using SMS to the contacts saved in the application database. The microphone and camera of the smartphone mobile device is turned on and data will be recorded and sent to the contacts listed on the app and to the EMS. The recorded audio and video could help the EMS to determine the severity and type of the accident.

This smartphone application *LifeSaver* provides a solution to help EMS support. The app is limited to smartphones that have post-paid plan for SMS and calls and requires stable mobile data. The application needs further validation with field testing and real-world trials to improve the detection of the accident. *LifeSaver* lacks report accident feature, it only uses sensors to identify accident and it also lack chat support. We come up with a solution and it is called *SAFE* that has report and chat support feature.

2.2 Related Systems

2.2.1 Ambuquick: Mobile-based Ambulance Sharing System

An application that can connect the user or the reporter to ambulances that are available in the area in times of need is what the Ambuquick can do. Ambuquick provides features that can help one ordinary citizen report a witnessed accident that needs medical service.

The application will be able to store one's information and distinguish its users. It will also hold its medical responder's information including the ambulance driver's information and the information of the medical responders with him. There are three major processes that builds up the application, the registration for both the user and the medical responders, the emergency services that they can provide, and the non-emergency services. The application will benefit for both the ambulance provider and the regular user in terms of cost and with its response time. A greater and more quick response time helps the victim save his or her life. With the help of Ambuquick, as they did research, it is seen that a patient can get a medical response 13 seconds quicker than the current system that exists.

This application differs from SAFE because SAFE can also provide the media sharing of the medical responder and the accident reporter which can help give more information about the accident.

2.2.2 Life-Saving System using IoT Technology

In tough emergencies, like the unexpected ones, we do not know how we will be able to face it because those kinds of emergencies are the ones where we are at most not prepared for. A team of researchers created an application that helps people respond to emergencies with the help of Augmented Reality (AR).

The mobile application that is developed became a tool for the emergency responders to address to the emergency situations which allows them, as a responder to that kind of medical emergency, to report, review, and scan information relate to the different significant information or the Points of Interest (PoI), such as control centers or medical posts, and accidents that could have probably happened during emergency operations, which can be differentiated into four categories: persons, infrastructures, security, and hazard.

For the augmented reality factor, the researchers created techniques whereas they view the surroundings with the application, he/she will be able to see the objects around them which are represented by symbols. In case of multiple items that are aligned with one another, the user will be required to move to another position so that the object behind the first object can be displayed. If a lot of events are in a small radius, the system can compile them which can be expanded again for better explanation of what is in front of the user.

They also took care of the problem with information that could help them that are not in view. In order for these things to be noticed by the user, they added a mini map that the user could also use to navigate its way around significant points. They also added an object selection technique where when an occurrence is selected, it gets more noticeable in terms of view which shows it has been labelled as an important event for the user.

The reported occurrence plays a big role in the application. The information about it is collected and distributed to different operational teams responding to the situation. With the information, the teams will be able to get a better understanding of the event where they get to specify the task that they will be doing related to it.

The application is similar to SAFE as both of them notifies the rescuers about a said or reported emergency. This application differs to SAFE as is lacks in some of the innovated features in existing applications which are utilized almost the same way. The location tracking and the feature of chat support is not seen with this system. In these days, these are the features that can help the system adapt to the current trends and mediums that can help one user in using technology.

2.2.3 Accident Detection and Smart Rescue System using Android Smartphone with RealTime Location Tracking

SOSafe and *SOSafe Go*: is an accident detection and smart rescue system using android smartphone with real-time location tracking. *SOSafe* is for the emergency victims and *SOSafe Go*: is for the emergency responders.

Using smartphones to identify road traffic accidents is not a new subject. There are completed algorithms for systems which utilizes accelerometers as well as GPS to detect vehicle accidents using smartphones to detect accidents dating back to 2011. Because there is already a lot done on this subject, what the researchers decided to do was to develop a complete system that is more reliable and has much more functionality than the existing ones, designed for the ongoing project in mind.

The authors provide the functionalities of their proposed system compared to the existing systems.

- Sends emergency notifications to the nearest available responder
- Real time location tracking for both victim and responder
- Provide directions to the nearest hospital
- Provide other emergency services

2.2.4 Automatic Accident Detection and Alarm System

Smartphones are getting intelligent, and it used by people every day. They are used for entertainment, communication and work-related with application such as emails, text messages, gaming, online payment, and entertainment. Pedestrians are seen walking and using their smartphone. Being distracted with smartphone while walking and may cause them accident. Ohio State University conducted a research study and found that injuries have more than doubled because they are distracted by using mobile devices while walking or driving.

Apple Inc. developed a “Transparent texting” last 2014, where the rear facing camera of mobile device continues capture and images of the environment in front of the pedestrian. These images are shown in the background of the text messaging application to help the pedestrian be aware of any obstacles in front of them. However, this application cannot be with other applications. Denso Corporation developed a pedestrian collision detection system. In this system a module is mounted in the vehicle to detect collision with pedestrian through wireless communication between the mobile device user and vehicle. This system relies on the module which detects collision and need communication between the pedestrian and vehicle, however some obstacles do not have detection communication capability.

Smartphones are equipped with sensors such as gyroscope, barometer, and accelerometer. In this system with the help of sensors it used to detect the walking direction of the user and speed. The gyroscope detects three orthogonal axes when the user walks, particularly, yaw, pitch, and roll. Accelerometer can be used to assume the speed of the user while walking. Object detection module have five core components these are image processing, feature extraction, classification, object recognition, and position estimation.

The accident analysis and prediction module will identify the speed and distance of the pedestrian. There is a calculation that the system will know that the pedestrian is in accident. Then the alarm module will alert user through text message, vibration of device and alert tone. This module can display an advice such “Stop walking”. The system is fully integrated with the smartphone and doesn’t require additional mounting device.

AutoADAS lack tracking of location and chat support. To improve the existing system, we come up with our research system called “SAFE” and it has tracking location and chat support feature.

3. Methods

Research Design

This study will use qualitative method for this research by the reason of dealing with the analysis of data gathered with the use of developed system.

Research Locale

The researchers have chosen the area of Binalonan, Pangasinan as the base of their research. They will pick normal citizens of the area and some local government personnel to try their application and answer a survey where they will be evaluating the application and answering questions about it.

Research Respondent

The participants will consist of 10 residents of Binalonan, Pangasinan. In the 10 participants, some of them are local medical personnel and some of them are normal residents who lives in Pangasinan.

Research Instrument

The researchers will be using a survey as their instrument where the content of it talks about the importance and the significance of the application.

4. Data Collection

Data gathering will be done by the researchers in the medical field, to be specific with the medical responders. The data that will be gathered should be able to see the effectiveness of having another medium of communication between a user and the medical responder. The data will also be able to provide the researchers what they can improve in the system including its functions and things that the system can do.

5. Results and Discussion

5.1 Graphical Results

The following graphs are the result of the UAT questionnaire answered by our tester.

On the first question of the UAT, based on figure 2, we observed that the respondents were mostly satisfied while some of them are very satisfied with the way how the texts are displayed and explained well.

The text are readable and easy to understand.

10 responses

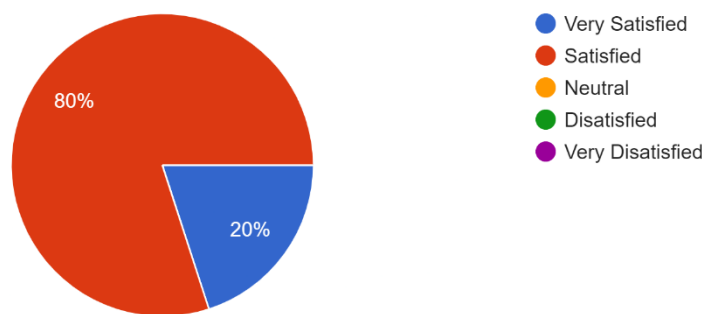


Figure 2. 1st Question of UAT User and Rescuer

On the second question of the UAT, based on figure 3, we observed that the respondents were mostly satisfied while some of them are very satisfied with the buttons and their functions that are present in the application.

The mobile application's button are functioning properly.

10 responses

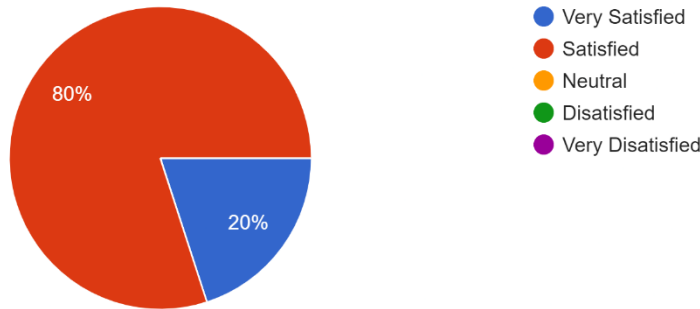


Figure 3. 2nd Question of UAT User and Rescuer

On the third question of the UAT, based on figure 4, we observed that the respondents were mostly satisfied while some of them are very satisfied with the color scheme and design used for the application.

The colors and design used in the mobile application are pleasing to the eyes.

10 responses

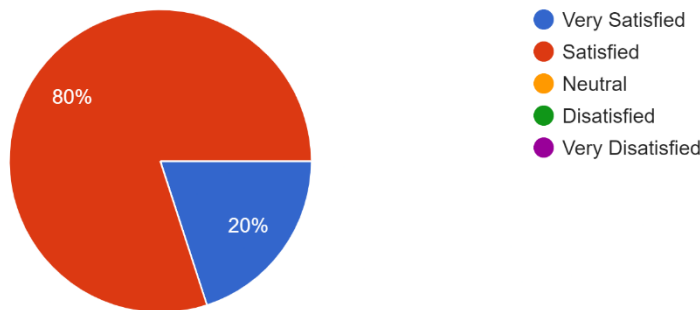


Figure 4. 3rd Question of UAT User and Rescuer

On the fourth question of the UAT, based on figure 5, we observed that the respondents were mostly satisfied and 10% of them are very satisfied on how user-friendly the application is.

Easy to use.

10 responses

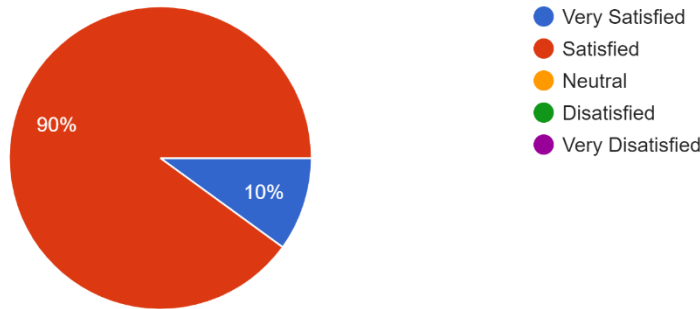


Figure 5. 4th Question of UAT User and Rescuer

On the fifth question of the UAT, based on figure 6, we observed that the respondents were mostly satisfied while some of them are very satisfied on how the features that can be seen in the application are functioning properly.

The features are properly working.

10 responses

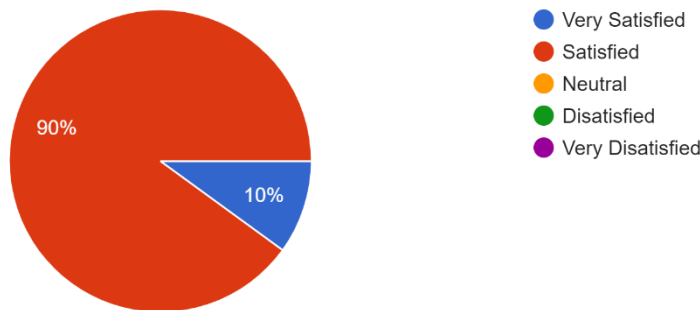


Figure 6. 5th Question of UAT User and Rescuer

On the sixth question of the UAT, based on figure 7, we observed that the respondents were mostly satisfied while some of them are very satisfied with the application in general.

Are you satisfied with the SAFE Application?

10 responses

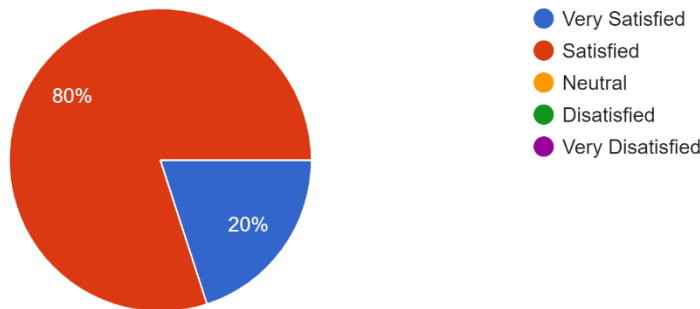


Figure 7. 6th Question of UAT User and Rescuer

We observed from the overall rating on figure 8 that some of the respondents are neutrally satisfied, 10% are very satisfied, but majority of the users are mostly satisfied with the SAFE mobile application to help them report and receive notification of an accident.

Overall Rating of SAFE

10 responses

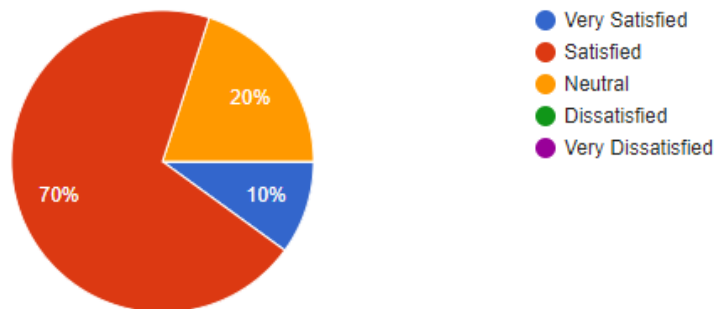


Figure 8. Overall Rating of UAT for SAFE

5.2 Proposed Improvements

The researchers recommend doing actual test runs for both the user side and the rescuer side. All the testing for both sides that have been done are online due to the pandemic. The researchers also recommend doing more tests for both sides to see if the response time can still be accurate in different situations. Adding more features to the application was also recommended by the researchers.

6. Conclusion

The researchers aim to create a mobile application that can be a tool that the community can use in times when a medical emergency response is needed. SAFE 's target users are the people in the community. Medical emergencies can happen at an unexpected time and place, with this app, people can easily call for help from medical emergency responders.

SAFE has different features that people can use in terms of easy profile identification, fast communication with the medical emergency responders, and a live location sharing for both the users and the responders. According to the results of the survey that the researchers have done for both the rescuer and the user side, these features can all be seen and used in the application easily and the users will be able to use them without any struggles.

Currently, the tool used in the Philippines for emergency response is through a hotline that can be accessible to both landline and mobile. With the help of SAFE, the application serves as another tool that people can use in order to report and accident and request for medical response. It can help both the emergency reporter and the emergency responders to connect to each other until the accident reported is attended to.

Some improvements were suggested by the researchers to improve the application's usability. The suggestions given are the following:

- Categorizing the emergency to respond to.
- Identifying what kind of emergency responder is needed.

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Biography

John Nicolo T. Cruz is a graduating Information technology student at Mapúa University. He was born and raised in the Philippines. He and his teammates developed a mobile application that helps people reports who need medical assistance. He wants to learn new things and when he has free time and loves to play video games with his friends. He also loves to watch anime and series after studying. One of his passions is taking care of his body by doing fitness exercises.

Gabrielle Angelo D. Gabatin is a graduating student of Mapúa University who is taking up the Bachelor of Science in Information Technology. He is one of the students who helped develop a mobile application called SAFE which can be used when someone needs medical assistance. He is studying and pursue front-end web development. Other than programming, he also loves doing team-related activities, sports, and playing video games.

John Gerick B. Gabunilas grew up loving computer games and technology. Amazed by how the game flows and how the computer systems work. Surrounded by two of his relatives who are both successful in Information Technology, because of this he turns more attention towards the matter. By the time he was in high school he learned some basic robotics, troubleshooting a system unit (hardware and software), more basic things about using the computer. By that time, his goal was to be a well-known hacker. Clearly, he watched too much hacking videos. Then it was time for college, he entered in a well-known school for Engineering and in Information Technology, Mapúa University. There, he met new friends who share the same hobby and passion. There he learns more about the field of Information Technology. With his friends, they developed a mobile application like Uber but for emergency rescue units. He is still learning and is eager to broaden his knowledge in information technology.

Gloren S. Fuentes is a full-time faculty member in Mapúa University. She is teaching Computer Science and IT Programming courses, and Information Systems specialization course – Business and Data Analytics in the School of Information Technology. She obtained a BS degree in Computer Engineering from Mapúa University, Master's Degree in Information Technology from Philippine Christian University – Manila. At present, she is also the CQI Auditor for Computer Science and Information Systems cluster.