Proceedings of Student-Faculty Research Day, CSIS, Pace University, May 8th, 2020

Mobile App for Public Safety

Dayanand Dyawarashetty, Karishma Saini, Jorgelina Alba, Danny Squicciarini, Charles C. Tappert
Avery M. Leider and Jamente Cooper
Seidenberg School of Computer Science and Information Systems, Pace University
Pleasantville, NY 10570, USA
Email: {dd6856p, ks04929p, ja47338n, ds15954p, ctappert, aleider}@pace.edu

***Abstract*—Our technocentric society has conditioned individuals to develop the expectation that emergency medical treatment will always be readily available during times of distress. Emergency medical responders are often pressured to provide services within areas too vast for their capabilities. This results in response times that are less than adequate. In the realm of lifesaving, minutes and seconds may determine whether an individual succumbs to their injuries or survives. The basic skills required to prolong the life of the majority of individuals who are suffering from a traumatic injury are not only within the grasp of emergency medical responders and medical personnel. The simple acts of performing cardiopulmonary resuscitation and applying pressure to wounds is taught to many individuals such as firefighters, police officers, military members, and other first responders. This effort will concern developing a mobile application with the primary goal of allowing individuals to report emergencies that involve patients suffering from traumatic bleeding wounds at high risk of exsanguination, as well as patients that are not breathing or who have a blocked airway. These reported emergencies will be forwarded to a network of certified off-duty professionals as well as first responders who are within the area of the patient and can expediently provide lifesaving measures before emergency medical responders arrive. The secondary goal of this application will be to provide first responders with a more accurate location of the patient in need by utilizing Global Positioning System technology.**

***Index Terms*—Application, Emergency Medical Services, Flutter, Mobile Application, Public Safety, Response Times**

I. Introduction

Recent technological advancements have an impact on almost every aspect of an individual's daily life. The daily activities impacted by technology vary from communication, transportation, commerce, to how the environment within your home is controlled. Technology has made open access to the internet and related information systems commonplace in nearly every corner of the planet regardless of the area's socioeconomic condition. In recent years there has been a documented rise in the number of individuals who are living within developing and emerging nations that are owning smartphones for the first time. These same individuals are beginning to regularly use the internet according to surveys conducted by Pew Research Center [1].

The commonplace availability of technologies such as internet connected smartphones, tablets, and smartwatches have farther reaching potential to serve the world's population over simply being used as convenience and luxury devices. Most individuals use mobile applications for communication, entertainment, and convenience. This undeniable truth is braced by the popularity and cultural significance placed on applications such as Facebook, WhatsApp, and YouTube. Bohmer et al. [2] concisely stated that mobile phones and their applications have become "increasingly analogous to a Swiss Army Knife" in that they are capable of bringing an ever expanding array of applications and features to their users that can be utilized in all aspects of their daily lives. Despite the wide array of applications available today, very few are designed with the specific goal of increasing public safety and promoting the preservation of life.

This research effort will focus on the creation of a mobile application with the explicit goal of becoming a tool that facilitates the delivery of immediate lifesaving medical treatment to individuals in need. The application will serve as a method of crowd-sourcing immediate medical treatment from vetted and certified professionals who have been trained to provide such assistance before emergency medical responders arrive.

II. Literature Review

A. Current Research Concerning Validity of Effort

Emergencies can happen anywhere, and the world is currently in a state where medical emergencies occur at an alarming frequency. Therefore, there is a dire need to develop a mobile application that works towards solving the problem of long emergency medical response times due to an overwhelmed public safety system. Concerning these facts, this paper will examine literature related to various emergency response related topics. This will be done in order to guide the development of a public safety application that will assist in saving lives by reducing the time it takes for an individual to receive lifesaving medical treatment.

1) Smartphones and Medical Applications in the Emergency Department Daily Practice: This study conducted by Jahanshir et al. [3] sought to establish the degree to which smartphones, as well as medical applications, have been integrated into the emergency department's everyday use. To achieve this, the study uses a standard questionnaire with demographic data as well as information concerning the quality and quantity of a medical app and smartphone use, which was sent to medical practitioners and interns. According to the results of the study, the use of smartphones is popular with interns as well as residents in emergency departments. The medical professionals who were the subject

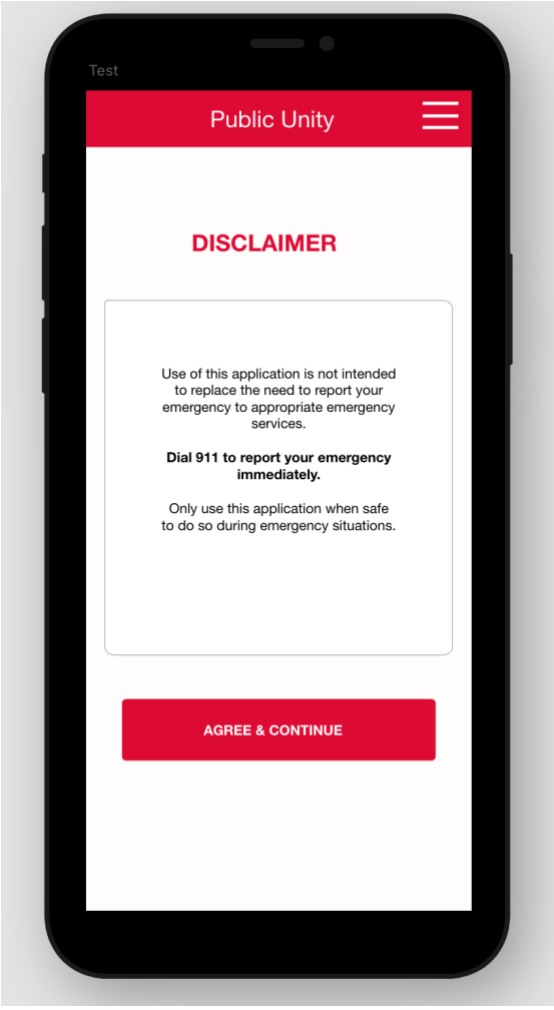

Fig. 1. Disclaimer Page for Application Prototype

of this study utilized mobile applications that allowed them to provide a higher level of satisfactory patient care. The use of mobile applications also reduced the amount of errors made in the course of patient care. The reduction in errors was led by the medical professional's ability to access the most recent medical information being distributed through the internet. Medical professionals were able to utilize medical mobile applications for functions such as "learning, education, decision making, medical calculation, and better interpretation of paraclinical tests" according to Jahanshir et al [3]. Medical mobile applications have also proven very useful when used by medical students. A significant number of them have a smartphone and they are using apps regularly within their medical practice. Significant problems concerning the use of medical mobile applications by medical professionals include that the screens on mobile phones are typically very small and that cellular and WiFi connections can be unreliable in certain locations. A key finding from this study was that the majority of use of medical applications was for seeking drug information, dosage, and other medical treatment options. Further studies must be completed to determine the safety of such uses during emergency and non-emergency situations relative to patient outcomes.

2) Emergency Accident Alert Mobile Application: This study by Sarlan et al. [4] was aimed at reporting the development of an Emergency Accident Alert mobile application used to send accurate alerts as well as a notification of emergency of an accident to an emergency call center. The methodology of the research involved Rapid Application Development Strategy to come up with mobile phones by using a phone gap, CSS, HTML, JQuery, and JavaScript. It was then followed by a usability test carried out on thirty-five respondents to determine the acceptability of the apps based on the top ten heuristic principles. Based on these findings, there has been the development of an Emergency Accident Alert Mobile application. The application has been effectively developed. It incorporates the ten heuristic standards to send notifications and alerts to emergency centers in a successful manner. Future work will be completed on this application to enhance its ability to screen whether reports are genuine or not. This process will involve utilizing "automated and intelligent" [4] screenings of emergency reports that are entered into the application. The research conducted in this report directly translates to possible features that the "Public Unity" mobile application may want to feature in order to screen reports entered into its mobile application.

3) Interaction Modes for Emergency Mobile Apps: This article by Nass et al. [5] presents a mobile application known as RESCUER, which makes it possible for its users to become a part of the emergency response. It achieves this goal by distributing information and receiving instructions concerning emergencies from a command center. They then go ahead and develop a human interaction model for emergencies so that they can have a clear comprehension of the capabilities of human-computer interaction of people who are in an emergency situation [5]. Using this model, the authors define the interaction modes that include chat interaction, one-click interaction, as well as guided interaction. Those interaction models were actualized in an intuitive model, and their assessment was done in an examination where the psychological burden was induced so it could reproduce a distressing circumstance that was equivalent to the stress experienced in an actual real-life emergency. The outcome of the examination indicated that the three interaction modes made it workable for individuals to communicate with the application despite being in the midst of a stressful emergency situation. The main requirements for user interface that were deemed most appropriate were that the application interactions should involve single clicks, the interface should guide the user through reporting the emergency, and also allowing the user to describe the emergency through a chat interface. The RESCUER application also allows users to take photographs of the emergency in order to relay the most accurate scenario information to the command center and emergency responders. This study is relevant to the creation of the "Public Unity" public safety mobile application in that it was conducted with the goal of becoming a solution

to the problem of emergency responders not having precise locations of emergency incidents. The RESCUER application uses crowdsourcing to gather and direct vital information to command centers that could then be relayed to first responders. The study also discusses the behavior and interaction that users have using mobile applications during emergency situations.

4) Development of a first aid smartphone app for use by untrained healthcare workers: A study conducted by Spies et al. [6] examines the feasibility of designing, developing, and testing a mobile application that would assist untrained medical workers in the delivery of common emergency care to individuals in need. These individuals in emerging nations would otherwise have no access to adequate medical services in a traditional facility or clinic. The study concerned the principal period of improvement as well as the testing of an automated Clinical Decision Support System (CDSS) device that can be utilized in controlling and explaining how to provide emergency treatment. The instrument is a mobile application that can help an untrained healthcare worker to offer essential crisis care to patients who cannot get emergency care or those who do not have access to emergency care. The tool will be designed in order to offer assistance so that the user does not need to be knowledgeable in the act of practicing medicine. This study relates to the ”Public Unity” public safety mobile application in that it relies on crowdsourcing individuals in order to influence a more positive outcome during emergency situations involving the need for emergency medical care. The study conducted by Spies et al. as well as the ”Public Unity” mobile application effort both realize that medical emergencies are an everyday common occurrence. Good samaritans are often nearby these medical emergencies and can assist the injured party with skills they already have or through instruction as detailed in the study by Spies et al. In certain areas of the world the shortage of trained medical personnel creates a significant public health and safety risk. The main limitations to the first aid application concerned pictures and diagrams not being integrated into the application. This would create a problem for individuals who cannot read or who need to see instructions in order to perform a first aid technique. The addition of voice commands would also allow individuals to focus on the injured party rather than holding their mobile device reading the first aid instructions.

5) Ambulance Emergency Response Application: This study by Sakriya and Samual [7] discusses the creation of an android based mobile application project that is intended to revolutionize how people are call for an ambulance and receive emergency services. The mobile application has been designed to be reliable and efficient for Emergency Medical Services (EMS) to use. The mobile application has been designed to help its users access the available ambulance without necessarily having to call hospitals to inquire about an ambulance. The mobile application has been designed to react with a single tap of a button. That way, it will be able to send the notification concerning the user and emergency details as well as location using Global Positioning System to the closest ambulance center. It will be then be the duty of the ambulance authority to approve or disprove the requested notification of emergency. If approved, the ambulance authority would then send the GPS location to the ambulance driver so that they can have a quick and accurate guided response to the emergency [7]. Global Positioning System based navigation systems would allow ambulance drivers to take the most efficient routes and be guided around slowdowns such as traffic congestion due to road accidents and construction.

6) Mobile applications in crisis informatics literature: A systematic review: Tan et al. [8] conducted a review to determine the involvement of mobile apps in crisis informatics literature as well as to look at the opportunity of further research. The results of the study showed that communication, which occurs during disasters, is more dispersed between the public and authorities. The main purpose of the study focused on how individuals use mobile applications during different types of emergency and disaster situations. The particular areas that were studied included how applications were used prior to the disaster response stage, the public's use of mobile applications, and the usability of the actual mobile applicaitons during disasters [8].

7) Operationalizing crowdsourcing through mobile applications for disaster management in India: The study conducted by Sukhwani and Shaw [9] looked at the state of thirty-three disaster related mobile applications available in India. The result of the study showed that most of the mobile applications were primarily educational so their general outreach had a huge limitation. This created a large need for Global Positioning System based apps that could assist in crowdsourcing information concerning and responses to large scale disasters. Being able to easily communicate vital disaster information would lead to better disaster responses in emerging and developing nations such as India. Information and communication technology, which would be promoted through the use of Global Positioning System based mobile applications during disasters would help the different phases of emergency management. These phases include mitigation, preparedness, response, and recovery [9]. Emergency public safety mobile applications such as ”Public Unity” stand to benefit from the same type of application design. The features most sought after and necessary for streamlined communication and emergency responses are Global Positioning System enabled navigation, location services, broadcasting of emergencies, and instant messaging.

8) A national census of ambulance response times to emergency calls in Ireland: A study in Ireland was conducted in order to measure ambulance response times to emergency calls within the nation. Nick Breen et al. [10] conducted this study by performing a national survey designed with the goal of collecting response time data concerning emergency calls that ambulance services within the nation were responding to. The study encompassed all nine ambulance services within Ireland for a period of one week. Key pieces of data collected included the type of emergency, the time of ambulance arrival and departure from the emergency scene, the location of the emergency, and the distance from the ambulance base of

operation. The study concluded that ambulance response times were often unsatisfactory due to ambulances being utilized for non-urgent emergency medical transports. The study suggested the establishment of priority-based dispatching protocols in order to reduce the response times to true emergencies.

9) New and fringe residential development and emergency medical services response times in the United States: Emergency service response times are directly impacted by the remoteness of the areas which are receiving the services. This reality was discussed in a research study authored by Thomas Lambert and Peter Meyer [11] in which they examined suburban and exurban emergency response times and the quality of such services provided compared to those within urban areas. The study addresses the relationship between response times and the likelihood of individuals surviving critical injuries when reached expediently by emergency medical services. It is noted by Lambert and Meyer [11] that the sizeable 70 percent decline in the murder rate since the 1960s has been largely attributed to the more widespread availability of emergency medical services.

10) Smartphone ownership and internet usage continues to climb in emerging economies: Emerging and developing nations have been experiencing a steep increase in the number of individuals who are now able to access the internet and own connected devices such as smartphones, tablets, and smartwatches. This information gathered by Pew Research Center indicates that as individuals within these nations increase their wealth and education levels, the frequency in which they use the internet and own smart devices increases in tandem [1]. This information speaks to the probability that the application researched and developed within this effort will have far reaching benefits to individuals within emerging and developing nations where timely emergency medical services may not be readily available.

11) Smartphone driven healthcare system for rural communities in developing countries: In this research conducted by Kulkarni and Agrawal [12], they suggest the creation of a healthcare system that would be based on utilizing smartphones and wireless biological sensors. This effort would be focused on benefiting developing nations. This is due to the fact that developing nations do not typically have access to quality healthcare systems. Smartphone and internet usage in emerging and developing nations is rapidly increasing making the feasibility of such an effort valid [1]. The population of all developing nations is much greater than the population total of all developed nations. This means that an incredible percentage of the world population is without access to quality healthcare. Developing nations are known to spend less on their healthcare systems and more on other aspects of their society. The low price of smartphones and wireless networks have led to even the most remote of regions in the developing world to have access to cellular service. The types of medical services that can be distributed by way of smartphone vary from teleconferencing with a live doctor, electronic prescription delivery, to monitoring the condition of patients. The entire system would be cost efficient and easily operated, especially if local clinics and hospitals were to support the effort in their local and nearby rural communities that are most in need of healthcare services.

Good Samaritan Law Protections by State		
State	**Code Section**	**Protection from Civil Liability**
New York	NY PBH 3000-A	Yes
Texas	TS 74.151	Yes
California	HSC 1799.102	Yes
Florida	FS 768.13	Yes
Pennsylvania	42 Pa.C.S.A. 8332	Yes
Illinois	745 ILCS 49/1	Yes
Ohio	ORC 2305.23	Yes
Georgia	OCGA 51-1-29	Yes

Fig. 2. Good Samaritan Law Protections in Eight Most Populous States [13]

12) Good Samaritan Laws: This article explains that the concept of Good Samaritan Lawshave their roots stemming from a story within the Bible. The concept is based on the premise of an individual who goes out of their way to aid another individual who is injured and in need of help on their journey. The individual who renders the aid does so out of good will and intention and does not do so in order to gain any type of compensation or favor in return. Good Samaritan Laws have been established in order to protect the individual who renders aid from legal liability. The theory behind having Good Samaritan Laws present in society is that it improves the world by protecting individuals who are willing to help others. These Good Samaritans seeking to help the injured party can focus on rendering aid rather than being concerning with the possibility that they may face legal liability if a mistake is made. West and Varacallo [13] detail within this article that all of the fifty states and the District of Columbia have Good Samaritan Laws enacted within the United States of America. This research article has implications that directly address whether ”Public Unity” mobile application users who are off-duty professionals would be protected from legal liability when rendering aid to individuals in need.

13) Timing and causes of death after injuries: The topic studied in this medical research journal is based upon the relationship between the types of injuries an individual receives and the eventual time and cause of their ultimate death. For the purpose of this research effort Sobrino and Shafi [14] divide the their ”mortality model” into three distinct types. The first type, which most directly correlates to the potential life saving ability of the ”Public Unity” mobile application, was typed as immediate deaths. Immediate deaths are described as those which occurred at the incident location, within an hour of being transported to the hospital, as well as ones that occurred in the emergency room of the hospital. The second type of death was labeled as early deaths. These deaths are described as those which occur within a few hours up until twenty-four hours of the injured party’s arrival at the hospital. The third type of death was labeled as late deaths. These deaths are described as deaths which occurred days or weeks after the individual received their injury. In this particular group of deaths, Sobrino and Shafi [14] have identified a pronounced

drop in the rate of deaths of this type between the thirty year period between 1980 and 2010. The noticeable decrease in documented late deaths is believed to be the result of improved trauma and follow up medical care provided to the injured. It was discovered from the cases that were studied as part of this research study that 39 percent of those injured died from exsanguination [14]. These facts bolster the validity of creating a mobile application that would facilitate the crowd sourcing of certified individuals that would be able to stem the bleeding of a critically injured person until emergency medical services arrive to take over treatment.

III. Methodology

As of today, many people are using Internet-connected devices. The ever-growing popular devices have changed the way users are interacting with media, exchanging their role from passive and unidirectional, to proactive and interactive. This document explains the high-level technical and functional requirements, and provides information about the roles and responsibilities needed to support the design and development of a public safety mobile application so named "Public Unity". This mobile application has the goal of providing a service which enables individuals to share intelligence about nearby medical incidents that they are experiencing or witnessing. By sharing their critical incident experiences they may decrease the response times of it will take from when an injury occurs to when first medical treatment is given. As this system captures all nearby reported incidents and provide notification to others based on their location. So, it helps to stimulate communication, cooperation, reciprocity, and social cohesion between all users in order to make the mobile application useful.

Based on the insights of the qualitative research on user's needs, we have highlighted all User Stories. In order to implement, this document will serve as the starting point for design and development by the project team.

Flutter :- Flutter is Google's mobile application SDK which has complete features to include frameworks, widgets, and tools. It is easy to build and deploy fast using this SDK. Another benefit is that development can be done on both Android and IOS platforms simultaneously.

User Authentication :- Flutter provides authentication libraries as a common task put on mobile apps.

Dart language :- Dart has been Google's modern programming language since 2011. It is intermediate with Object Oriented Programming and Generics.

FireBase :- To setup and store CRUD Operations.

GeoLocator/Geolocation Plugin :- This Flutter geolocation plugin is helpful to track specific locations of incidents and to provide notifications on nearby incidents.

Figure 3. displays the process of building the mobile application using Flutter. Flutter consists of widgets that allow developers to build the contents of the application using widgets. As displayed in Figure 3. we can see the process begins with the Material App widget that displays the navigation portion of the application. Next is the contents for the home screen, then the Scaffold widget, and then it is divided into two parts. The AppBar and the Center alignment for the text for the Home Screen application.

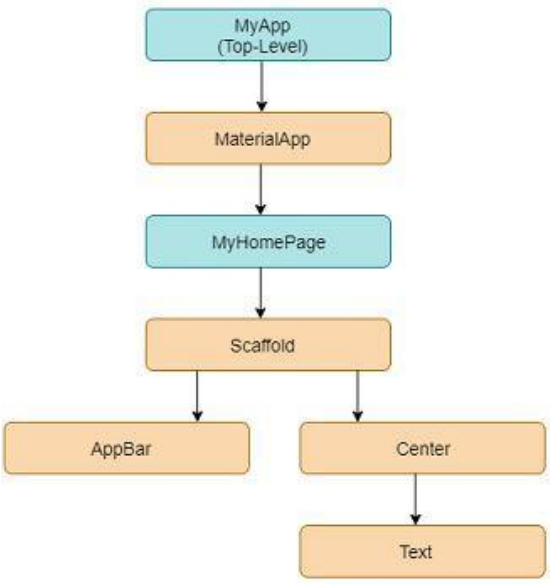

Fig. 3. App Flow Diagram

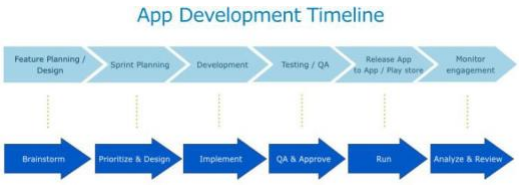

Fig. 4. App Processing Project Timeline

A. User Stories

User story is a concept used in Agile software development to capture a description of a software feature from an end-user's perspective. The story describes the type of user, what he or she wants, and the reason for it. The user story allows developers to understand the requirements needed for building the application. User stories are structured in the following ways.

- Epic
- User Stories

An Epic is known for the overall big story or large bodies of work that can be broken down into smaller stories. The user story template is, as a **user type**, I want **his/her goal** so that I can **benefit**.

Epic: ***Registering for the Application***

User Stories:

1) As a civilian user, I can register for the application by entering my name, email address, password, and confirming my password.
2) As a civilian user or as a first responder user, I want to receive a confirmation email once I have registered for the application so that I can confirm my email.
3) As a professional user, I want to receive a confirmation email once I have registered for the application.
4) As a civilian user, I can register for the application through my Google account so that I can securely access my account with my work or personal email.

Epic: ***Managing User Profile***

User Stories:

1) As a civilian user, I want to be able to easily edit my profile and privacy settings.
2) As a civilian user, I want signing up for the application to be easy to accomplish.
3) As a professional user, I want to be able to adjust the distance of emergency alerts in order to receive only near-by push notification emergency alerts.
4) As a first responder user, I want to be able to only receive emergency alerts within my area of responsibility.
5) As a civilian user, professional, or first responder user, I want to be able to contact the application support system, so that I can report my concerns.

Epic: ***Reporting an Emergency***

User Stories:

1) As a civilian user, I want to be able to report my emergency quickly and efficiently while under stress.
2) As a civilian user, I want my location to be shared with professional users in order to receive near-by assistance.

Epic: ***Responding to Emergencies***

User Stories:

1) As a first responder user, I want a push notification to alert me to emergencies within my area of responsibility.
2) As a first responder user, I want each reported emergency event to be mapped and to receive navigation guidance to the location.
3) As a professional user, I want to receive push notifications concerning emergencies within my area so I could provide assistance.

B. Use Case Diagrams

The use case is divided into four sections. These sections consist of systems, actors, use cases, and relationships. The system could be a website, software component, a business plan, or an application. For our use case diagram, the system will be our mobile application named ”Public Unity”. The ”Public Unity” mobile application is represented by a rectangle

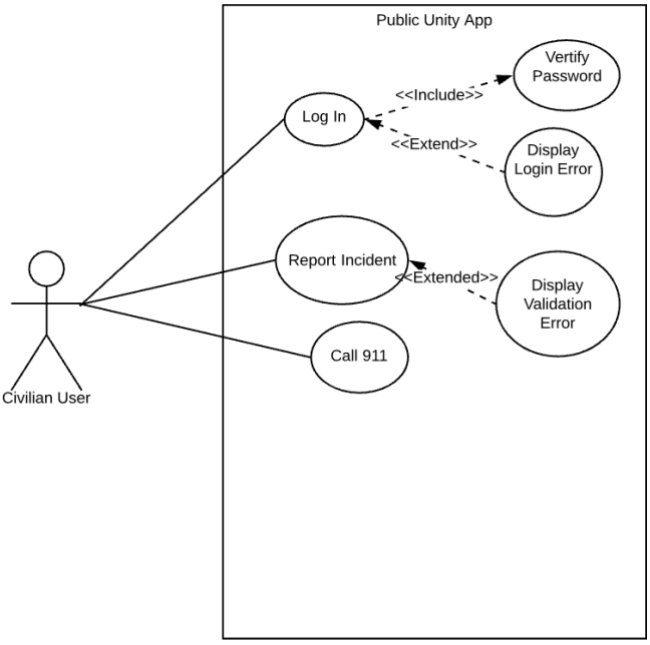

Fig. 5. Civilian User: Use Case Diagram

along with the application name placed at the top of it. In Figure 5, the stick figure is known as an actor. An actor is someone or something that uses the application in order to achieve a goal. The actor could be a person, an organization, another system or an external device. There are three distinct user types that will be using the ”Public Unity” mobile application. These three distinct user types are civilian users, first responder users, and professional users.

There are two types of actors that exist in a use case diagram, primary actors and secondary actors. The primary actor initiates the use of the application while the secondary actor is considered more reactionary in their role. The primary actors for the ”Public Unity” mobile application have three main roles, civilian users, professional users, and first responder users. The secondary actor would be Google Maps, since first responder and professional users require Google Maps to provide locations as well as provide navigation to the incident locations featured within the ”Public Unity” mobile application. In the use case diagram, the primary actor is placed on the left side while the secondary actor is placed on the right of the rectangle as shown in Figure 6.

Inside the rectangle contains the oval shapes which indicate a use case(s) or representation of an action that accomplishes some sort of task or goal within the application. A civilian user of the application logs into the application to either report an incident or to call 911. As shown in Figure 5, it will

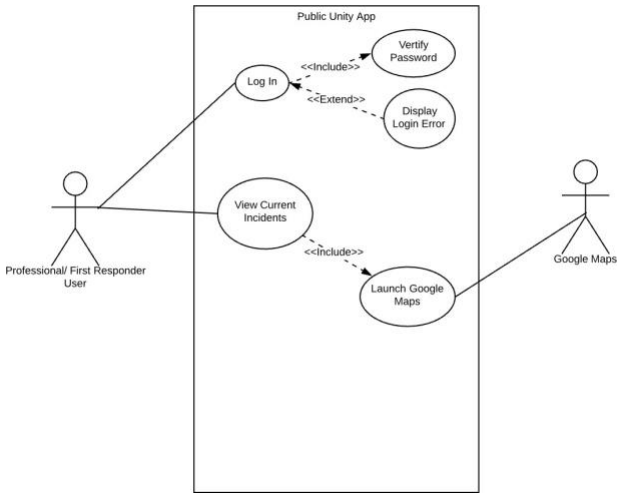

Fig. 6. First Responder/Professional User: Use Case Diagram

display three main actions the civilian user can achieve using the mobile application. In every use case diagram, an actor is required to have at least one interaction with the use case(s) in the application. The solid line indicates the interaction the civilian user will have with the application.

When the civilian user logs in, the application will automatically verify the password to check if the user has entered the correct password. This is known as include relationship, which displays the dependency between a base use case and an include use case. Every time a base case is executed, that include use case is executed as well. In Figure 5, the civilian users logging into the application need to enter the correct password in order to log into the application. As the civilian user is logging into the application, the application is verifying the password automatically. Once the password is verified, the civilian user can access the application. In the use case diagram, the include relationship is indicated by a dashed arrow to the include use case with the text 'include' on the dash line.

While an extend relationship has a base use case and extend use case. When the base use case is executed, the extend use case will occur if specific criteria are met. In Figure 5, the civilian user will only receive an error message if he or she has entered an incorrect password. The extend relationship is also indicated by a dashed line, except the arrow is pointed towards the base use case and it contains the text 'extend'.

C. Wireframes

Wireframes are a blueprint for a web application, mobile application, or software system. It allows members of the team to become familiar with the overview of the application's structure and layout. Also, wireframes determine how the user flow, functionality, and the intended behaviors should be implemented on the actual application. There are three main purposes for using wireframes. First, wireframe concepts are mainly user-focused, second it defines the application features, and third wireframes are quick and easy to create.

Wireframes are excellent tools to identify a user's main interactions with an application. It is critical for the designer to understand how the user will use the application in order to implement a user-friendly interface. Since wireframes are meant to define the application's features, it will allow the members of this project team to visualize how the "Public Unity" public safety mobile application's features will work together. For example, there are three roles, civilian users, professional users, and first responder users. Therefore, our team implemented a sign up form that allows users to register based on the type of account they select to sign up with. If a user selects the civilian role, a disclaimer screen will appear before the users can report an incident or dial 911 to report medical emergency. When the users select either the professional or off-duty responder user account, the application will display a screen to encourage users to download a specific document as proof of their professional qualifications. It is a very simple and user-friendly approach. Lastly, wireframes are quick to create using pen and paper to sketch out a rough draft of the "Public Unity" mobile application wireframe. Of course, there are software tools available online that could be used to create the rough draft or low fidelity wireframe. Low fidelity wireframes are one of the three types of wireframes available for use in user experience designing. The three types of wireframes are low-fidelity, mid-fidelity, and high fidelity.

Low fidelity wireframes, as mentioned earlier are basically a rough draft with few images, minimal text, and simple boxes using minimal color. This process will allow the designer to map out the user flows, and identify the navigation layout and features of the application. For example, for the "Public Unity" application our team needs to determine what the main features of the civilian user account should be. The main goal of the civilian user role is to report an incident or dial 911 for emergency medical help. Therefore, our team thought it would be ideal to keep the application very simple. The home screen for a civilian user will display two main buttons, "Report Incident" and "Call 911". This was our approach to mapping out the civilian account when the user signs up or logs into the application, the home screen will display those features. We found a free trial software called Mockplus, which allows a member of the team to build a very simple low fidelity wireframe for the civilian user screens as shown in Figure 7. Mid fidelity wireframes are implemented in a simple color concept using grayscale theme. It is created manually, using digital tools to create more detailed and realistic components of the application. This process will help identify the essential functions of the application to make it user friendly. For example, for the "Public Unity" application our team needed to determine the user flow when the user signs up for specific account types. What screens should display when the user select a civilian account or when the user selects either a professional or first responder account. Therefore, we thought

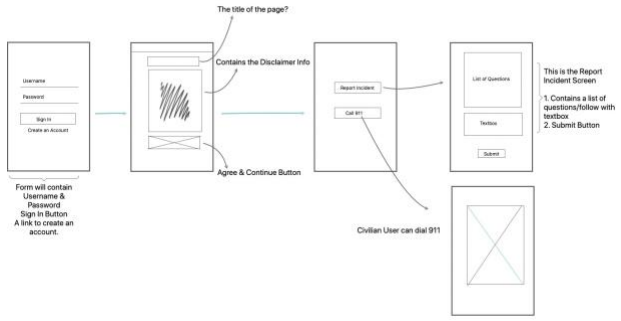

Fig. 7. Low-fidelity Wireframe: Civilain User Screens

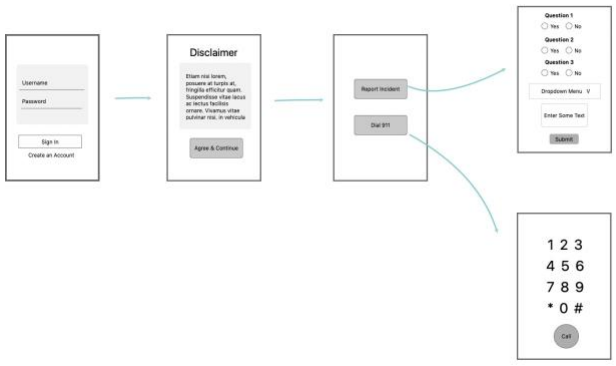

Fig. 8. Mid-fidelity Wireframe: Civilain User Screens

it would be ideal when a user signs up as a civilian account, and selects the sign up button. Then the application should direct the civilian user to a disclaimer screen before the user report an incident or dial 911 for medical emergency. As shown in Figure 8, the disclaimer screen contains some dummy text in order to visualize how the screen may look in the "Public Unity" application.

High fidelity wireframes are the final product, which contain the color scheme of the application and presents screens that are closer to how the application would appear in the final version of the application. For the high fidelity wireframe, our team decided to use Adobe XD software to implement the final stage of the wireframes. As shown in Figure 9, these are how the screens will look when the user selects the civilian account to register for the "Public Unity" application.

D. Qualitative Method

In order to gather the necessary data and user input of this mobile application, the methodology of the research will involve a combination of participant observation and a focus group. Since time was very limited, the majority of the test subjects that are selected, will be graduate Pace students from the computer science and internet technology capstone course who possess an Android. They need to see their role as one of value and see the importance of helping someone in need. These test users will then be

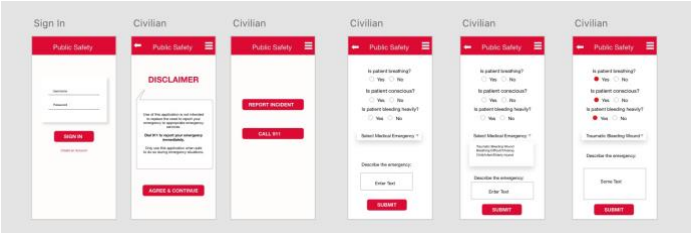

Fig. 9. High-fidelity Wireframe: Civilain User Screens

asked to download the mobile application. After downloading the application, they will be able to create an account and utilize the application. After careful use of the application, a survey will then be distributed to them. This test criteria survey consists of three input sections: general use of the application (launching the application, verify sign in/sign up, screen/button/menu layouts), Civilian Application Perspective, and Professional/First Responder Application Perspective. After completion of the survey, we will then utilize these test users input to see where we need to improve.

IV. Installation and Usage

The installation process for each user will be the same, except for the usage. The first responder and professional users will have similar usage experience, except for the civilian users. When signing up, users will be able to choose the type of account (first responder, professional or civilian) they would like to have. If "first responder" or "professional is selected, users will have to upload the appropriate file, such as their certification(s), to confirm they are qualified to assist others when in need. When the documents have been received and verified, the first responders and professionals will be able to access their user account.

A. Installation

1) Access Google Play Store from a mobile device and search for "Public Unity".

2) Once prompted with the Public Unity mobile application, click install.

3). When installation is complete, open the Public Unity mobile application.

B. Civilian Users Usage

Upon logging in, the civilian users will see a disclaimer they most agree to in order to continue using the mobile application. After pressing Agree and Continue, two buttons will be displayed: Call 911 and Report Incident. Before reporting an incident, it is suggested to call 911. When selecting Call 911, the users will then be redirected to their mobile device's dial pad. After calling 911, the users can then select to report the incident. The users will then be asked to describe the incident by answering a few simple questions. When done, the incident can then be submitted and nearby off-duty professionals/first responders will be notified. These users do not have the Google Maps feature. This prevents unqualified individuals from knowing the location of incidents and medically assist.

In the menu section, there are three options: settings, contact us and logout. In the settings, civilian users have less features compared to the first responder/professional users. In their settings, these users are only able to modify the applications' theme mode preferences. Additionally, they have the ability to edit their profile, change their password and delete their account in the Account section in Settings just like the first responder/professionals.

C. First Responder/Professional Users

When logged in, first responder and professional users immediately see a list of current nearby incidents that the civilian users have reported. Each incident listed includes its location, the type of incident and the time it was reported. When one of the listed incidents is selected, the users are redirected to the 'Incident Details' screen. This screen displays a full description of the incident and a Google Map with a marker pinpointing the location of the incident, unlike the civilian users. When clicking on the marker, users will then be redirected to Google Maps where they will get directions to the location the incident took place. Besides seeing the incidents within the mobile application, users will also be able to see these notifications in their mobile device's notification center, as long as they turn on notifications from Public Unity.

In regards to the menu, first responders/professionals have extra features unlike the civilian users. In the settings, users can modify their preferences such as the app's theme mode, map and distances type (e.g. feet and/or meters).

V. Preliminary Results

The preliminary results of this effort's mobile application design and development have been very positive and informative. An intuitive, simple, and quick to manipulate user interface was developed. This ensures that users of all different levels can use the mobile application effectively while under great deals of stress. The back end and front end of the mobile application have been seamlessly blended to provide a fluid experience for all levels of users. Proper security protocols were developed to ensure that first responders and professional users are properly vetted and documented in the back end of the mobile application. By utilizing an API key from the Google API Console, Google Maps was able to be incorporated into the first responders and professional users account. This helps pinpoint the exact location where the incidents have occurred, thus, enabling these users to navigate and get directions to the locations.

Although the development of the mobile application was a success, it is still under review by Google Play due to adjusted work schedule of their employees. This can take up to one week or more. Once it has been reviewed and successfully listed on the Google store, the mentioned test users will then receive a survey after utilizing the application, both as a civilian and first responder/professional.

VI. Conclusions

Conclusions drawn from this effort include that it is believed that the level of death resulting from traumatic injuries can be greatly reduced. This reduction will be the direct result of crowd sourcing basic life saving services from trained individuals that can get to the injured party before conventional emergency services can. The greatest increases in critical injury survivability will be witnessed within regions that are remote, rural, or part of developing nations where basic emergency medical services are not sufficient in their current state.

VII. Recommendations

Recommendations for future work include conducting a study based on specific regions and the usefulness of the "Public Unity" public safety mobile application. These different regions would be selected with diversity of location in mind. This would allow for the study to focus on the performance of the different aspects of the application in urban, rural, and extra-urban areas. In addition, to further expand the popularity and awareness of this mobile application, an iOS version of it would also be recommended. For security purposes, two-factor authentication can also be implemented. This would include implementing OTP (One Time Password) into the mobile application in addition to the users' account password. OTPs can be obtained by any known authentication app that must be downloaded separately in conjunction with Public Unity.

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