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Design and Development of an Incident Reporting Mobile Application

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ABSTRACT

Reporting actual incidents through short messaging systems and telephone calls are tedious, prone to errors and misinterpretations. Developing a mobile application that can be utilized to transmit incident type, location, and images among other details can provide assistance in emergency situations. The software development method followed in this study was the prototyping model, where initial versions of the software were shown to the end users for it to be refined to their needs. The target users of the mobile application are a group of 38 Adventist motorcycle riders from Silang, Cavite, Philippines who are trained to be first responders. Interviews with end users and benchmarking on related systems were conducted to meet results. The end users' feedback on the developed application can be summarized as having high accuracy, less prone to errors, and ease-of-use. Through Global Positioning Systems available on modern smart phones, reporting a specific incident location can be as accurate as within five meters. The report receiver can view the location in a map. Minimizing text entry and utilizing control elements not only improve reporting time but also reduce chances of committing errors. Further, the application can provide map location and contact information of the emergency facilities near the incident site. Reported information is also centrally stored for references to improve response processes. Once substantial data is gathered from this system, it can be data-mined to predict possible hotspots, peak times and other information on the occurrences of incidents. To implement the system to a larger geographical territory, the proponents suggest employing artificial intelligence which can automatically identify and request help from the nearest possible medical facilities.

Keywords: Incident Reporting, Emergency Rescue, First Responders

INTRODUCTION

The Adventist Community Service (ACS) Riders, founded on July 2016, is a group of professional motorcycle riders that volunteers in any vehicular accidents in Silang, Cavite area of the Philippines. The group is a member of Adventist Community Service of the local churches under the Cavite Adventist Mission. The group is also a member of Silang, Cavite Civil Society Organization that functions as one of the first responders in an emergency. The

group attended several seminars regarding basic life support, rescue techniques and road safety conducted by the Philippine Government's Metropolitan Manila Development Authority. The group has 38 active members which is composed of 26 males and 12 females. Their age ranges from 39 to 60 years old. Additionally, there are 30 auxiliary personnel that function in livelihood education and medical missions.

Currently, the ACS Riders uses short messaging systems, telephone calls, as well as social network messenger to communicate emergency situations with other members. They are not utilizing GPS Systems that can accurately describe the exact location of an accident for rescue purposes. Further, communication information with the nearest possible emergency facilities as well as local government units of Silang, Cavite from incident's location is not readily available or updated in order to report the incident, and to seek further help. The ACS Riders lack a centralized, searchable and detailed documentations of emergency responses that they have attended to. This results to difficulty in the preparation of reports, listing of accomplishments and activities that can be useful in their organization management and operations.

The main objective of this study is to design and develop an application that can be utilized to transmit and document incident type, location, and images among other details so that the ACS Riders can be able to have a unified approach in providing accurate fast and effective response to emergencies.

LITERATURE REVIEW

In 1968, "9-1-1" is designated as a universal telephone number for emergency assistance in the United States of America. In that time, modern technologies like Global Positioning System (GPS) and cellular phones were non-existent yet. When citizens make emergency calls, the Public Safety Answering Point (PSAP) where 911 calls are received dispatches emergency personnel. The PSAP has computer programs for dispatching personnel. The software also has provisions for mapping the location of the caller and also identifies any specific hazards or special information that respondents may need to know (NYSAC, 2018). About 70% of the 911 calls in the United States are made from cellphones. According to a Public Safety Answering Points (PSAPs) report, 15%–20% of incoming 911 calls are non-emergency calls.

The Philippine government established a similar emergency response system by institutionalizing the Emergency 911 hotline as a nationwide emergency answering point.

The Public Answering Center of the 911 hotline is under the supervision of Department of Interior and Local Government. The local government units are tasked to establish and run local 911 call centers within their area. The major first responders of any 911 calls are the Bureau of Fire Protection and Philippine National Police (Executive Order No. 56, s. 2018).

Emergency situations occur regularly, may it be man-made such as civil disturbances, fires or even life threatening situations like a heart attack, or even unexpected childbirth. Moreover, societies today are challenged by countless natural calamities like hurricanes and flash floods. When these things happen, entire villages, cities or geographical regions can be affected and they need to be sheltered. Emergency systems that will enhance rapid response is important. Managing these challenges require defined and well accepted processes and an enormous amount of data that can be collected, processed and analyzed. Therefore, fast and accurate management of information and communication is needed (Lehnardt, 2017; Knoll, 2016; Krumay & Brandtweiner, 2015).

According to Sy (2017), one of the global problems we have are car accidents. It is estimated that around 1.25 million individuals around the world die due to car accidents. In Manila, Philippines alone, more than 10,000 die annually from road accidents. The age range being the most vulnerable are between 20 to 24 years old. About 33% of road crashes in Metro Manila happens in Quezon City (Reformina, 2017).

Data and technology plays a growing role in the improvement of emergency management departments as crises are increasing across the country (Torres, 2018). As evidence, several related studies were conducted such as the Development of an Open-Source Mobile Application for Emergency Data Collection conducted by Spångmyr (2014) in Sweden. The research utilized a mobile application for emergency field data collection. Through the use of mobile phones, even data from resource-poor organizations can be harnessed. These data can be collected rapidly, accurately and updated which can promote and enhance collaboration and adaptation. Such information may be of vital importance for emergency management in order to enable the right resources to be distributed to the right places at the right time and to prioritize the most beneficial efforts. Much of this essential information has a spatial component, such as extents and locations of damaged areas, the locations of resources and services or safe transportation routes. Such geographical information or spatial information is useful in all emergency management stages (Cutter 2003; Al-Khudhairy 2010). The research provided an adequate proof-of-concept and showed that it was possible to implement the system to a specific emergency field data collection task.

In Kenya, another study about emergency services access through mobile based directory was conducted by Wachira (2016). Different emergency services providers in the country were identified and reviewed in order to develop a geo-location based mobile directory that can provide information on how to get to a nearby emergency center regardless of where in Kenya the user is situated. The directory system utilizes a phone's Global Positioning System (GPS) to know the user's location and uses this information to search an emergency provider database for the nearest center's contact information. This is proved to be useful, accurate and reliable as compared to paper-based directories that easily gets dated, or even web-based directories which is time-consuming in cases of emergencies.

Another similar system was developed in Cebu City, Philippines by Ramirez, Pondoyo, Laya and Bahio (2016). The system has a mobile and a web-based component. Once activated during an emergency, a phone's geo-location data will be used to locate the nearest emergency units and display its stored emergency hotline. It can also send the user's location details to the identified emergency units and also broadcast an alarm to at least five emergency teams to ensure that the emergency request is relayed. Further, a web application is also created to manage emergency units and contact information, as well as for users' signing up process and downloading of the mobile application.

In spite of having different manners of design and implementation from other researchers, there are common ideas that are shared with the current, proposed system. The stated related systems and the proposed system all utilized a mobile phone's GPS that can pinpoint the exact location of the user, all have centralized database to store and retrieve data, and requires network connectivity in order to function.

METHODS

The proponents conducted interviews with the president together with other members of the Adventist Community Services Riders to collect data on how they respond during emergencies and requests for help. Based on the collected data, the proponents brainstormed on how to enhance the response of the team. Further, based on the organization's activities, the proponents developed diagrams that could illustrate the flow of their operation and how such operations can be enhanced. During the development, the system is tested on each iteration to see if the function worked or needed to be improved. On each tests, bugs and errors are noted revised and corrected to reach the system's objectives.

The proponents used the Prototyping Method as basis for the planning and development. According to the Institute of Electrical and Electronic Engineers (1990) prototyping is "a type of development where emphasis is given to developing prototypes at an early stage, to enable early feedback and analysis to support the development process". Prototyping, as a type of software engineering method, is commonly used when the end users do not exactly know what they wanted beforehand. It provides faster development time and reduce complexities significantly. To start with, an initial prototype with basic functionalities desired by the customer is created. The end users utilize the prototype and gives feedback which identifies what they wanted. The prototype is further refined by eliminating unwanted features and adding possible functionalities that are needed. The process is repeated until the customer is satisfied.

The proponents utilized PHP scripting language for the development of the website. It was also used to access Application Programming Interface (APIs) to interact with the mobile application and other web services. Several PHP frameworks were used to streamline the entire development process and to ensure the security in the application. The CodeIgniter framework was utilized to provide the basic structure of the website which contributed to the timely development of the web portal. The Bootstrap framework helped the developers to make the website responsive. Responsive web design allows the automatic resizing, hiding, shrinking or enlarging of a website to make it adapt to different screen sizes. This framework allowed the proponents to use common standardized structure that reduces time and complexity of writing codes from scratch. The React JS library allowed the application to be fast and simple. One of its features is that it can change data without reloading the page. It employs JSX, a syntax extension to JavaScript, that allows quoting of HTML and further uses this syntax to render subcomponents. HTML syntax is processed into JavaScript calls of the React Framework.

React Native was utilized for the mobile application development. In this framework, the proponents were able to build a native application for Android using familiar web technologies. This also enabled the proponents to decrease several inefficiencies in development such as the slow writing process for debugging deployments. The slow, compiling process can be replaced by a simple refresh of the mobile application after making code changes. Firebase, a Google-backed mobile and web app development platform, was also utilized in the system development. It includes several products, such as real-time database that allow us to use a cloud hosted NoSQL-based database that can be synchronized

across connected devices. It also has the capability to be available even when there is no network connectivity by temporarily employing the local cache. Its crash reporting feature also helped the proponents by providing a trace of all crashes in its console. It also has Maps SDK for Android that add Google Maps capability to the application. The API manages Google Maps server access, data download, map display, and geophysical expressions response automatically. API calls may also be used for adding markers, overlays to the map and changing the users view for a certain map area. These objects provide additional information and allow for better map functionality.

RESULTS

After the analysis and considerations in the development of the systems, the following diagrams are the generated output necessary to achieve the objectives of the study. For the system to achieve optimum design and simplicity, the proponents utilized the Unified Modeling Language (UML) Use Case Diagram. The UML Use Case is a methodology used in system analysis to identify, clarify, and organize system requirements (Aleryani, 2016). It shows how a system interacts with the external entities. It lays out every single detail of how the system behaves internally and how the external environment is arranged. A set of specialized symbols and connectors is used to build one. It helped the proponents in visualizing the requirements and process. It also helped in identifying correct process in the system for changes.

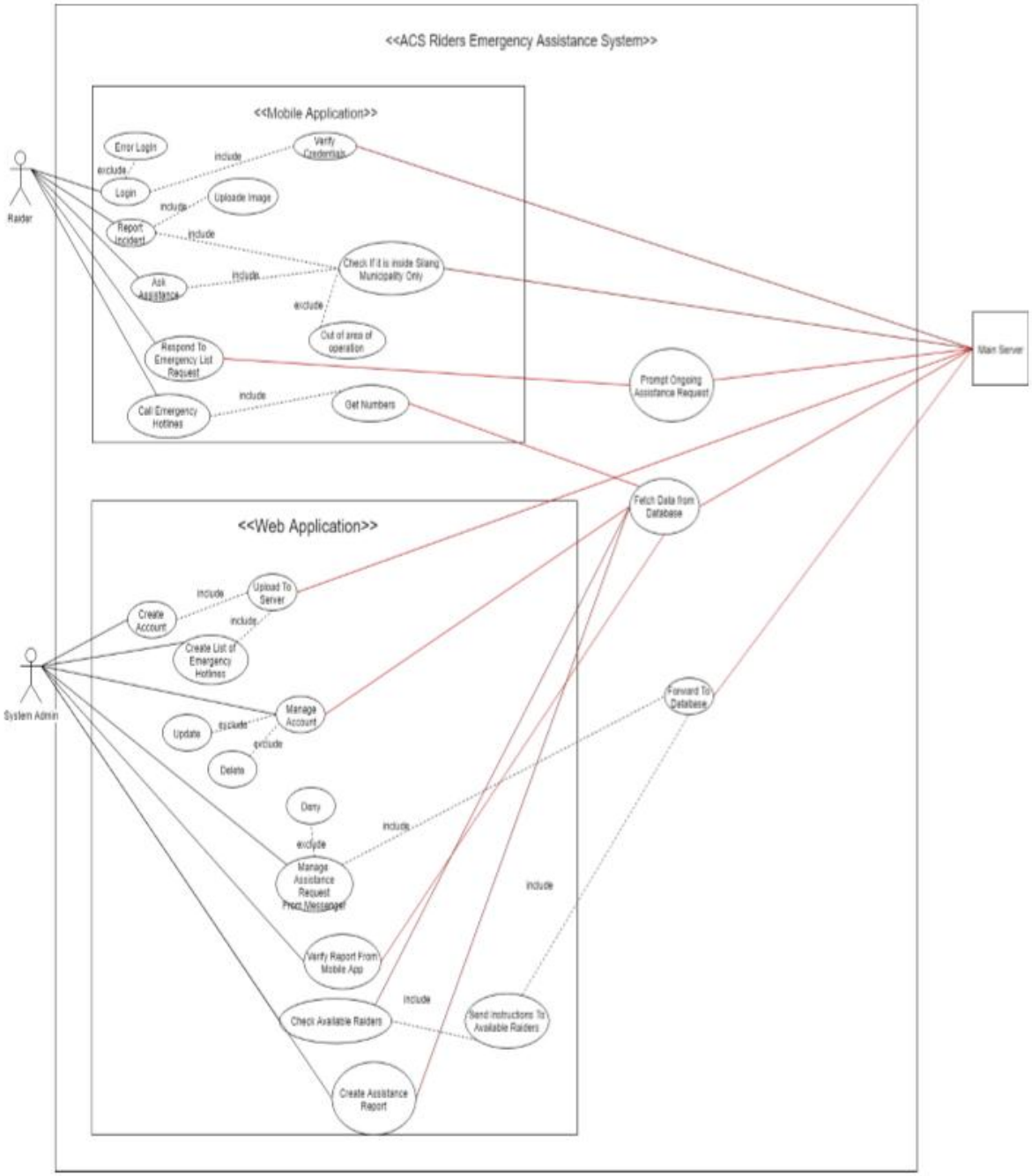
The proposed system is made up of two components, a mobile application and a web-based application. Both require internet connectivity to function properly. Only active members of the ACS Riders are given valid credentials in order to gain access to the system. System administrators and systems users have their own respective access rights.

The mobile application is currently available for the android operating system. It allows users to post and/or read any incident. Posts can be seen by other members of the group. Incident location can be viewed through a map. If needed, requests for assistance from other group members can be performed after posting an incident. If the incident requires more help, contact information of government and emergency centers near to the incident area is also provided.

The web application can be run in any recent web browser. It is developed mainly for overall system management. It is in this component were user accounts, government and emergency centers contact details, incident details and assistance requests can be created, retrieved,

updated, or deleted if needed. Reports generation can also be performed using the web application.

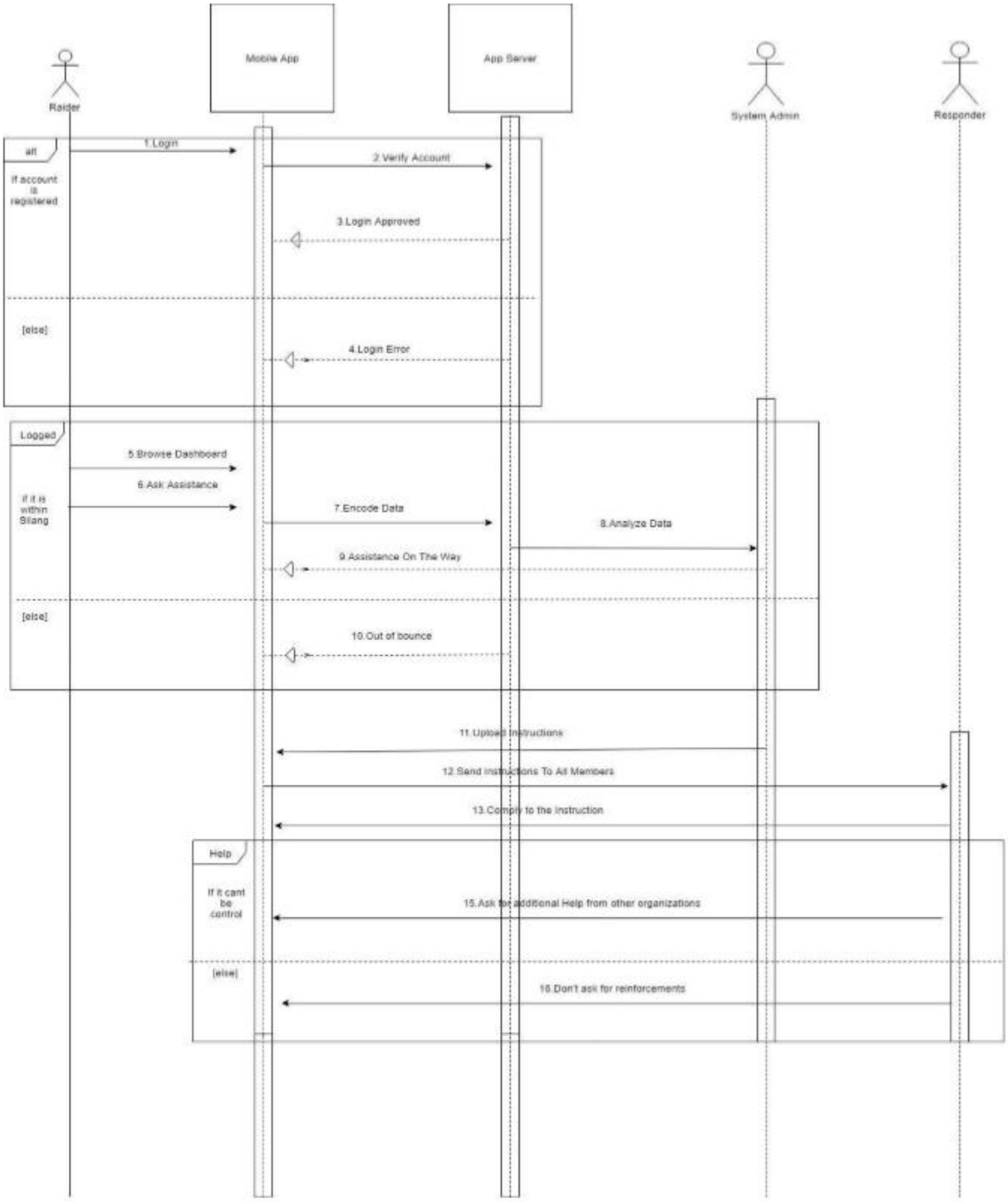
Diagram 1. ACS Riders Emergency Assistance Use Case Diagram



For the dataflow of the system, the proponents use sequence diagram. To model interactions between objects, sequence diagrams are used. A sequence diagram describes when and in

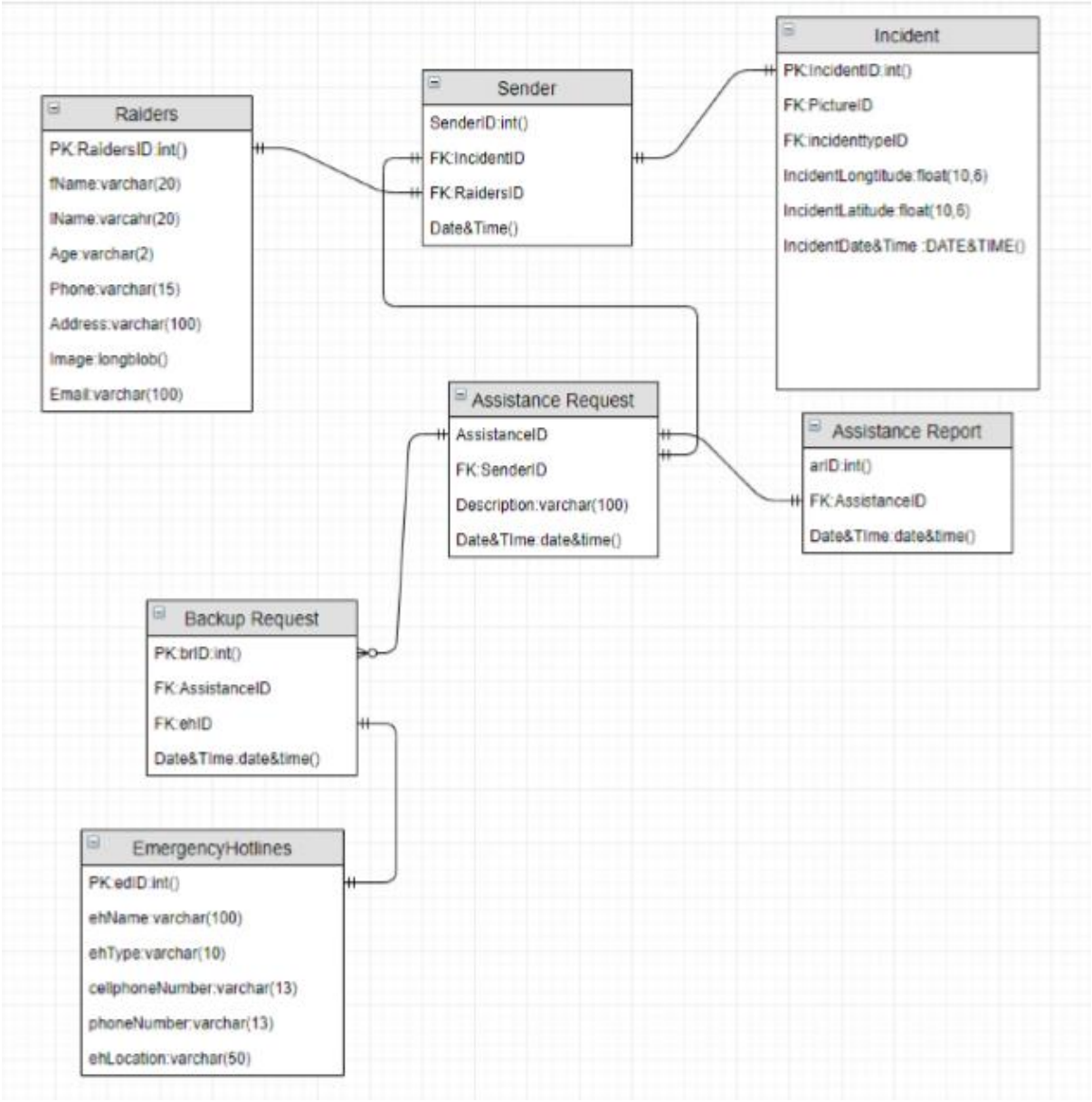
which order method calls are executed (Rumpe, 2016). It helped the proponents to understand the flow of data that guide them in the development.

Diagram 2. ACS Rider Emergency Assistance System Sequence Diagram



For the database design, the proponents used an Entity Relationship Diagram (ERD) to illustrate the entities in the database. The ERD is a semantic data modeling tool used to accomplish the goal of describing or portraying data. Abstractly described data, called a conceptual model, leads to a fixed description of the structure of the data. (Bagui & Earp, 2011).

Diagram 3. ACS Rider Emergency Assistance System Entity Relationship Diagram



DISCUSSION

The objective of the paper to design and develop a system for the ACS riders in responding to emergencies is achieved through technologies available today. The prototyping model is considered very effective in this study's context because the end users are not fully aware of

features and capabilities the proposed system should and should not have. It is important that the system is able to do what is necessary and should be able to do so in the clearest and quickest way possible. This has been evidenced by the positive feedbacks such as having high accuracy, less prone to errors, and ease-of-use, as provided by the ACS Riders group.

A flaw observed during the testing of the system is the position accuracy of a mobile phone of one of the proponents which showed none to intermittent GPS connection on certain geographical locations. It might be due to some environmental factors, mobile phone build or age of the hardware that caused such event. All other phones used in the testing provided close to accurate results.

Further studies can be obtained from this endeavor. Once fully utilized, data gathered from the proposed system can be mined to predict possible hotspots, peak times and other information on the occurrences of incidents. A broader research that covers a much larger geographical territory can also be conducted but the proponents suggest employing artificial intelligence capabilities which can automatically identify and recommend the nearest government offices or medical facilities that can provide appropriate help based on the reported incident, as well as to automatically send request for help if the reported incident requires so.

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