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Design and Development of a Road Accident Cases Reporting Mobile Application

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Abstract

Software development life cycle (SDLC) was implemented by use of prototypes. The results obtained during the study ABSTRACT Road accidents in Zambia claim approximately 3000 lives every year and leave a number of people with serious injuries or lifetime disabilities. To save lives after an accident is an issue that needs rapid response by the emergency service bodies. This has been a challenge in Zambia as there is no well-coordinated way of reporting accidents and deploying emergency personnel. Despite the fact that there are numerous emergency service providers more often the challenge has been to report to the nearest service provider as there is no way for the person at the accident scene to know where to report to. The frequency of road accidents is on the rise in Zambia with many accidents going noticed by witnesses but unreported or reported late. One main reason is lack of a simple and reliable medium of reporting directly to the concerned parties. A unified way is not available for most witnesses to report. The aim of this work was to investigate weaknesses in the current system of reporting road accidents and response by first aiders with interest to provide a more significant solution. A study was conducted on Red Cross Society staff and members of the public on their experience and opinion on the current manual system. An investigation of the most common methods used for reporting road accidents was done and the results indicate that most respondents are not confident that the current system ensure minimal response time to road accidents. The current system is not efficient enough since some accidents end up being reported and responded to very late. From the survey, it was noted that there is need for applying technology in reporting road accidents and responding by first aiders. In this study, a road accidents reporting system was developed. A mobile cum web app was created and used to report accidents. Relevant parties can get alerts through the app and action immediately to save lives. Location information is supported by the app and depends on a smartphone inbuilt GPS module. Also, the progress of the reported accidents can be checked in the system. The development of the system followed a waterfall system development life cycle especially at testing, indicate that the developed system if used properly will make reporting and response to road accidents almost real –time and easy. It will also increase number of accidents reported since anyone with a smart phone can just report by inputting a single entry then submitting. Many lives may be saved due to very fast response to road accidents in Zambia with improved coordination of first aiders and integrated communication.

Keywords: Telemedicine, Artificial Intelligence, Healthcare Access, Public Health, Data Sharing, Healthcare Innovation

Introduction

Road Traffic Accident (RTA) is the major causes of mortality and morbidity around the world and Zambia is not an exception. It has been discovered that low- and middle-income countries are the ones that have been affected most. The estimation by the World Health Organization states that the minimum of 3000 people are killed daily in road traffic accidents and 30,000 others injured globally (Krug *et al*, 2000). In Zambia for the year 2019 according to Annual Crash Statistics recorded that the total of 1,746 men, women and children lost their lives on our roads representing 4% fatalities (2019 ANNUAL ROAD TRAFFIC CRASH REPORT). Hence to reduce the number of fatalities and respond quickly to road accidents, the proposed app will be used by the public to send information to Road Traffic and Safety Agency Call Centre for quick response.

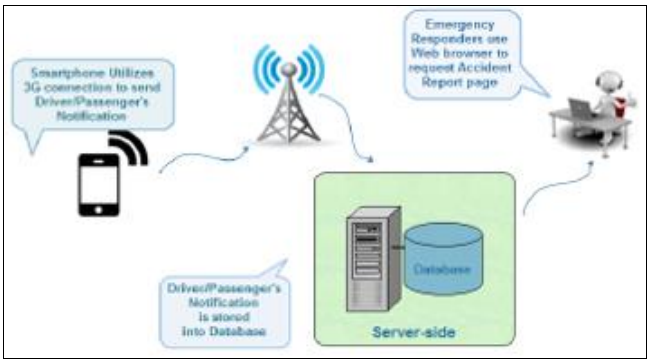


Fig 1: Application Architecture

Motivation

From the survey, it was noted that there is need for applying technology in reporting road accidents and responding by first aiders. In this study, a road accidents reporting system was developed. A mobile cum web app was created and used to report accidents. Relevant parties can get alerts through the app and action immediately to save lives. Location information is supported by the app and depends on a smartphone inbuild GPS module.

The bigger the project size the higher the likelihood of not fulfilling all system requirements, the developer's understanding of this principle will ensure that the final product not only meets functional but also non-functional requirements making the solution both effective and productive.

This is made possible only included components of most importance and are a definite necessity towards the successful achievement of the set-out goals and objectives the main of which is improving service delivery through quick and effective information processing and management, in view of this objective additional software component use will be limited in order to regulate system size and maximize performance levels.

Problem Statement

Currently in Zambia monitoring of road traffic accidents depends on road users and pedestrians who take photos and videos which are uploaded on Social media platforms which then get to the attention of RTSA or Zambia Police. This has proven to be quite a slow process and in some cases accidents are not attended to in time.

The proposed system will be a real time downloadable app that will be used by public to send accident alerts in form of pictures and videos with a location and then send to Road Transport and Safety Agency who will be able to send accurate information to the emergency response call center at RTSA and the information will be then passed on to the nearest police station or RTSA station for quick response.

General Objective

The main objective was to develop a mobile and web-based system to be used by eyewitnesses for reporting road accidents to enable first aiders to respond to such emergencies within their localities just in time.

Specific Objective

1. To investigate the existing technological methods used for reporting road accidents.
2. To evaluate the weaknesses and challenges of current technological methods used for reporting road accidents.
3. To design, develop, test and deploy a prototype mobile based/web-based system for reporting road accidents.

Research questions

1. What system is currently being used for reporting of accidents?
2. What challenges are associated with reporting of accidents?
3. Is it feasible to design and implement an app?

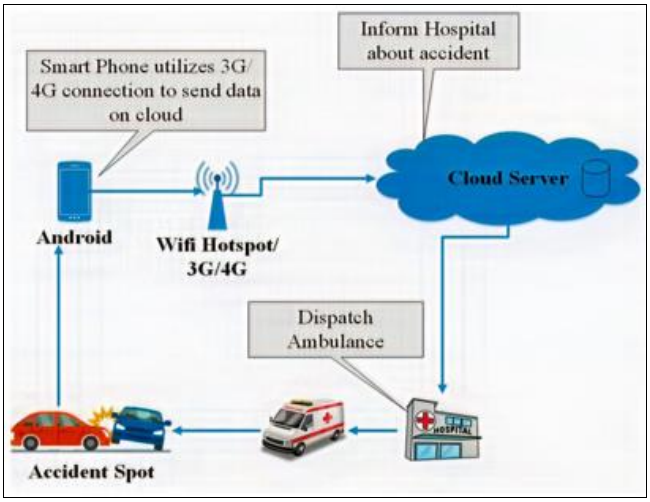
Literature Review

The result of the developed system shows that road safety officers, users, policy makers and all other stakeholders can be able to register, login, submit reports and run queries on information that has been previously entered into the system such as the accidents that occurred on a particular route or the accident in which an identified victim was involved. Policy makers can run these queries to take appropriate steps in minimizing road traffic accident occurrences.

The use of GPS on mobile devices in the recent generations of mobile communication is one of the ever-present applications that are widely developed and used. But using those GPS in case of emergency such as accident, where there is no user interaction will be difficult effort. Android is a new and yet dynamically developing mobile platform and almost all counterpart of application are being adopted to compact the systems requirement. Hence Android can answer for this, by developing an application which can solve the above mentioned problem.

Therefore, it is proposed to develop an application based on android platform which will help to send the GPS data with remote server and eventually serve the purpose of emergency situation location information sharing to the appropriate authorities such as hospitals, relatives, traffic police etc. in case of traffic accident.

System design



Registration of Help points i.e. hospitals and police stations.

e) Access on mobile app for all users and web for police, first aiders and administrators

f) Send alerts to first aiders about deployment areas.

g) Create web-based database and update all events 5.2.

Non-functional Requirements The following are the key non-functional requirements of the system. a) The system should not allow unauthorized users to register and modify accident records. b) The central server has to be provided at secured area and made constantly available c) The system must be simple and easy to be used by all its potential users d) The system ought to execute as projected. Given the essential input, it should give the anticipated output. e) The system should be extendable or scalable to future needs f) The system should be available and in good state at whatever time it is required. g) All constituents should be available, and integrity of data should be warranted. h) The degree of failure should be very minimal. i) The system should be consistent in all of its functions. 5.3 System Inputs and Output The system has 4 important actors as users – the reporter, system administrator and the first aiders and police. With the application any road user can send an alert to trigger the system to send broad-cast 33 messages to local first aiders, police and paramedics. Name of the physical location of accident is send to the local first aiders in form of SMS. To police and paramedics, information such as name, the physical address and the nature of the emergency is given. In summary, the inputs of the system will include alert from road user / victim and also update messages from local first aiders and paramedics. The outputs of the system include information to first aiders, police and paramedics. The system comprises of a database with 4 tables. One table contains details for first aiders: Full names, Mobile contacts, current residence location. Table consists: Locations of Police stations and contacts of police and another Table has: Range of geographical coordinates of physical locations with corresponding local names and Mobile contacts of respective hospitals. 5.4 Use Case Diagram A Use Case model captures Use Cases and relationships between actors and the system. It describes the functional requirements of the system, the way outside entities (actors) interact at the system boundary, and the response of the system. The use case diagram is illustrated below: Figure 14: Use Case Diagram Report Accident Login Create Database Update Database View Report Update Report Delete Database Police First Aider Administrator Road User1796 34 5.5 Class Diagrams Class diagrams are used to define the organization of a system in terms of classes, attributes, operations, and association of objects in the class. Table 8: The Database Schema 1796 35 5.6 Implementation Technology The system was developed as an Android App in Java Environment with SMSLib for SMS functions and MySQL for database services. It also involved development of Web portal with prime faces and embraced SOA. The system implementation technologies are discussed as follows: 5.6.1 Android Operating System This is the greatest widespread mobile phone operating system in the world nowadays. Selecting this platform with Java language for execution of the system implies that more people are expected to have access to it therefore making it more beneficial. 5.6.2 Mysql Database Management System MySQL is the most prevalent Relational Database Management System due to the following reasons: Open Source- It is free and can be used by anyone without any license or authorization. Easy, Fast and High Performing - This Database is easy to use, and it operates very fast. As it is essentially a improved version of SQL, a general understanding of SQL is enough to work proficiently with MySQL Cross Platform Supports - It can relate to all major Operating Systems in addition to Windows without a loss of performance. It also runs with various development interfaces like JDBC, ODBC, Pearl,Python, PHP and C++. This is mainly because the development APIs that are unified with it. Memory Factor- MySQL checks memory leaks thus facilitating efficient resolutions for information storage. Data Security - MySQL secures the stored data. This makes this database system safe and reliable as in popular cloud solutions such as Microsoft Azure. An unauthorized access to data is not possible since, it is secured with encrypted database passwords. Special authority and rights are subjected only to authorized entry.

Methodology

The methodology that will be used is qualitative research method will be used in a proposed application to solve the problems with the current system. The research method will be based on the survey that will be conducted. Interviews will also be used a data collection tool as well as questionnaires.

This project will be developed by using JAVA programming language which is executed on Eclipse IDE and implemented on Android mobile platform.

Functional requirements

After gathering information from the stakeholders which in this case are the blood donors, recipients, and the blood bank, we came up with a list of requirements as listed below:

- Create users.
- User authentication.
- Store user's information.
- Search function.
- View user information.
- Administrative privileges.
- Call donor function.
- User logout.
- Password reset.
- Edit user's information.

Non - Function Requirements

- The performance of the Application can be determined by its responsive time, time to complete the given task. When Application is made to start up it shouldn't take more than 3 seconds to load the initial screen. Also, it should be made sure that the app will have no hindrance to the User Input.
- The app should be able to adapt itself to increased usage or able to handle more data as time progress when the user data (caches, stored data, etc) increases app should be capable of handling them without delay by optimizing the way storage is done and accessed.
- The application should be responsive to the user Input or to any external interrupt which is of highest priority and return to the same state, When the app gets interrupted by a call, then the app should be able to save state and return to the same state/ page which was there before it got interrupted.
- Users should be able to understand the flow of App easily i.e. users should be able to use apps without any guidelines or help from experts/manuals. If user experience needs to be explained, then it's not good UX.
- The application should be reliable to perform the business, i.e. when the user performs some important

action it should be acknowledged with a confirmation. Like when the user who's a receiver wants to call the donor the app requests confirmation from the device to make the call.
- All the app data should be secured and be encrypted with minimum needs so that it's protected from the outside environment also from internal attack. All authentication tokens are saved on firebase for comparison and need user permission to gain access, Password is all encrypted.
- There should be a common plane where the user can access your application to install and look for regular updates give feedback f*or* example on *the* Google Play Store.
- Now a day's lot of mobile devices come with different screen sizes and layout, So the application can render its layout to different screen sizes. It also provides for an automatic adjustment of Font size and image rendering.

Fact-finding techniques were used throughout the early stages including database planning, system definition, and requirements collection and analysis stages. This helped me to learn about the terminology, problems, opportunities, constraints, requirements, and priorities of the blood bank and the users of the system. During the development of the system, interviews, and questionnaires were carried out with blood bank workers, blood donors, and blood recipients to get information which was crucial to the system requirements and to have a clear understanding of how the blood donation and giving of the blood to the recipient is conducted. Observation was also used during this information-gathering period.

Modular Design of the system function

Introduction This chapter discusses the system architecture of both the front-end and back-end sides of the application outlining the various requirements needed for the implementation of the application. This involves the presentation of the context diagrams, sequence diagrams, use case diagrams and, the entity relationship diagrams (ERD). 4.2 System Architecture The front-end user is the road user in possession of a mobile phone with the road incident reporting application installed. The front-end user files a report from within the application. The filed report contains the details of the road incident being reported. The report is stored in the backend server that resides at a police station. Front-end users also have the option to view road incidents have been posted by other users. This acts as important information to them especially if there is an incident that may concern them while on the road such as a road accident. The backend user has a more refined view of the reported files. The user can track reported incidents like over speeding public service vehicles, carjacking incidents and road accidents. These are all monitored on a map in the backend user's personal computer since the font user and backend user share the same source of data. Figure 4.1 shows an overview of the components of the system. Front-end user File reports Back-end user Report tracking data Figure 4.1: System Architecture 25 4.3 The Three-Tier Architecture The system was built around the 3-tier architecture. 3-Tier architecture is that unique system of developing web database application which works around the 3-tier model, comprising of database tier at the bottom, the application tier in the middle and the client tier at the top. This 3-tier architecture module is the framework for most Web Applications on the Internet. This system helps to separate the Business Logic from the Application, Data Storage and database. Figure 4.2: Three-Tier Architecture The client tier represents the front-end and back-end section of the whole system as shown by Figure 4.2. The front-end user interacts with the system using his/her mobile phone while the backend user interacts with the system through a backend web interface. The business logic tier represents the code behind the system that runs on an application server. Finally, the database tier holds the database of the system. The business logic tier interacts directly with the database whenever there is data required but the client tier. 4.4 Context Diagram Figure 4-3 presents a context level diagram of the back end and front-end user application. It shows how the parties involved interact with the system as well as what data is exchange between the two.

The normal user (Front end user), registers into the system. The user gets a registration confirmation that allows him/her to be able to report road incidents. The 26-backend user on the other hand, also has to be a registered user. He/she is registered as an administrator in the backend of the system. Figure 4-3 gives the context level diagram. Figure 4.3: The Context Level Diagram 27 4.5 Entity Relationship diagram (ERD) Figure 4.4 is an Entity Relationship Diagram (ERD) showing the structure of the database of the road incident reporting application and the relationships between the tables.

Conclusion

The literature review outlined in this chapter has fed into the design of the mobile accident cases reporting system in the following areas:

a) Geo-mapping of incidents reported onto Google maps.
b) B) The mobile phone as a reporting tool.
c) The system will operate with a central web-based server for data storage.
d) Gathering of data is done via crowd sourcing techniques.

Recommendations

Though, the Mobile app system has tried to implement most of the functional requirements required and defined for the system, there are some more additional tasks to be addressed and others to be handled extensively as it has been learned from related systems or products being used in other countries. If more resources are available, we can implement this using cloud computing techniques and include voice recording as a future work.

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