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EMERGENCY ACCIDENT ALERT

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Emergency Accident Alert

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Dissertation submitted in partial fulfilment of
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CERTIFICATION OF APPROVAL

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CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or person

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NURLIYANA BINTI ROSLAN

ABSTRACT

The escalation of the fatalities of road user has triggered a serious concern in the country. Factors identified were communication problem between the caller and the call-taker cause delay in the process of saving the victim which then become a source for insufficient preparation at the hospital. By utilising the knowledge of the current evolving technology which is now a trend, the author suggests to develop a mobile application that encourages bystander and eyewitness of road accident to immediately send details of victim's condition to the emergency operator. The method used for the development of this Emergency Accident Alert is the Rapid Application Development (RAD) model. A prototype that describes the functionalities of the system will be developed using Phonegap that blends in HTML, CSS, Javascript and Jquery (scripting languages) to produce the desired mobile application.

ACKNOWLEDGEMENT

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INTRODUCTION

1. Introduction

1.1 Background Study

"Their apology won't bring him back" (Mpongwana, 2015). In Bristol a young woman by the age of 27 undergo a heart-throbbing moment when she had lost her husband due to 5 hours delay in waiting for the ambulance to come (Smith & Spillett, 2015). Lisa's husband, Mthuthuzeli Mpongwana, 38, is another victim of the silent killer meningitis disease. Lisa was informed that a blue-lights ambulance will be send straight away but after two-and-a-half-hour later, only a rapid response car arrived instead of the ambulance. It took additional 3 hours more for Mr Mpongwana to be able to reach the hospital (Smith & Spillett, 2015).

The situation that occurs during an emergency call was made is that the call will be directed to an emergency medical dispatcher. There are some ambulance services that split the emergency medical dispatcher into two roles, the call takers and dispatchers. The call takers function is to remain calm while taking the necessary information of the patient's conditions, the current location and will immediately transfers the data into the computer system. The emergency dispatcher's duty is to make a crucial and real-time immediate important decision based on the situation given (NHS Careers, n.d).

NHS Careers (n.d) website stated that for the task of emergency medical dispatcher and call takers that has been combined, the emergency medical dispatcher will answer urgent call that has been made to the control centre. The control officer in charge will give orders to the emergency medical dispatcher to perform the same task of call takers in addition to the job done by emergency dispatcher. For certain cases, the emergency medical dispatcher might need to assign and notifies the nearest ambulance, rapid response car, motorcycle or might be to the extent of calling paramedic helicopter.

Association for Safety International Road Travel (n.d) states that there are approximately 1.3 million people met with fatal accident in road crashes every year. Average number of deaths per day reaches 3,287 people. The world is in a state where the number of road accidents had reach an alarming level. Adding to the figure, 20-50 million people are injured or became disabled due to road accidents.

The process flow of how the emergency call was handle is that the 911 operator or the police communications officer will be the first person to receive the call. Under the cases where the caller reports any injuries, the emergency response team (ERT) dispatcher will be notified. Should the caller is in an uncertain injuries situation; the operator will wait (Brodsky, 1992). Tucker (2015) suggested that identifying foreseeable situations, understanding the causes and effects and prepare emergency response plan and procedures ahead of time is a crucial job that needs to be done by the ERT manager in ensuring that the ERT team which purpose is to stabilize the effects of an emergency act as a primary response to emergencies.

There are many difficulties faced by the emergency operator when it comes to the situation of handling emergency calls for instance miscommunications. Stivers et al. (2011) stated “misalignment refers to mismatching between structural properties of different conversational contributions, so that the projected sequence of activity is in some way hampered” (as cited by Svennevig, 2012). Misalignment of communications between call-taker and caller might end up in risking someone else’s life. Svennevig (2012) said that the dissatisfaction expressed by the callers regarding the call-takers inability to entertain their request at crucial moment might lead to complaints by the caller. This may prolong the time taken for the ERT to save the victim.

Woods (1988) and Means, Salas, Crandall and Jacobs (1993) stated that there are factors that are able to influence human decision making in managing emergency such as the time pressure, stressful situations where the operator is afraid of the failure to manage emergency and high workload of managing multiple task (as cited in Kontogiannis, 1996). This may leads to wrong information to be transferred at wrong time that may cause the inability to save victims life.

1.2 Problem Statements

The main problem that leads to the delaying of saving a victim's life is the **Communication barriers**. Delay occurs when the caller fails to communicate about the victim's condition and also the location of the accident and thus making it difficult for the operator to respond to the situation immediately

1.3 Objectives

There are several objectives that are needed to be achieved for this project:

1. To identify Emergency Medical Services (EMS) business processes.
2. To create a mobile application for bystanders to be able to deliver information to emergency call operator.
3. To assess the usability of the mobile apps developed.

1.4 Scope of study

The Emergency Accident Alert (EAA) aims to provide a medium to allow information to be transferred to the emergency operator in a quick manner and at the right time. The medium that can be used is a smart phone user where the user will be able to use the EAA to communicate the conditions of the victim and the exact location of the accident to the nearby hospital. The mobile application that will be develop is for Android operating system

1.5 Research Importance

When mentioning about a lost gadget especially mobile phone due to carelessness, can make a person's days, months and years fill with regrets. What about losing life when there is a split second chance to save them? The importance of this research is mainly to study about how revolving technology in current era will be able to become medium for life saving. Through the development of mobile application,

bystanders are able to lend a helping hand by sending fast information via Internet to the emergency operator for immediate response. Information may also be conveyed faster and clearer through texting rather than verbal communication which may be interrupted by noise and accent.

1.6 Research Motivations

In the year 1992 where the first smartphone was introduced by a company called IBM Simon (McCarty, 2011). It is the year where the world had step into a new world in which technology begin to emerge into the life of the earthlings. After 23 years, the development and innovation of smart phone has gone far beyond what mind can perceive more than two decades back then. With the advancement of technology nowadays, we can use it for our own benefits to save human life.

With the wide range of capabilities of the smart phone, it can be fully utilise during the occurrence of an accident. Instead of dialling the emergency number, bystanders who witnessed the scene could lend a helping hand by using their smart phone. With the aid of Internet connection, detailed information regarding the victim could be send directly to the emergency operator. By fully utilising the technology, we are able to help in saving a person's life.

Developing a product that is meant to be used by various age levels is a challenge. Not everyone is capable of understanding the flow and functionalities of the system. This is where the importance of usability came into view. ISO 9241-11: Guidance on Usability (1998) stated that usability can be define as "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use" (as cited by Ascheim, Blank, Fuster, Hutchinson, Kamano, Kimaiyo, Misoi, Tuikong, Tulienge, Vedanthan & Were, 2014). Thus, a key important factor of success of a system is that it has to be usable to user to achieve their goals of using the system.

1.7 Research Methodologies

For this research, there will be an interview session conducted at a hospital in Penang to identify the exact flow during an emergency call. The person that will be interviewed will be the staff in charge at the Accident and Emergency Unit. The staff from the hospital will be interviewed and the information obtained will be used as a clarification on the process and procedure of EMS. The flow is important as we need to correctly identify the business process of the Emergency Medical Services team during the occurrence of accidents.

Secondly, after acquiring adequate information on the flow, an Android mobile application prototype will be built to accommodate the needs of enabling the bystanders to provide help by utilising their smart phones to send information regarding the accident scene and the condition of the victim. The information send will be crucial as it will allow enough time to save the victim's life.

CHAPTER 2

LITERATURE REVIEW

2. Introduction

The first section of this literature review will give the reader an insight of the current world state where technology starts to take place in every segment of human's life. Within the technology itself there are several systems and devices that are widely used for the past few decades which are the global positioning system (GPS), cloud databases and smartphones.

The second section will illustrates how these technological components have made a huge breakthrough into the medical world where a huge number of people's life have been saved thanks to the advancement of technology. The last section will exemplifies a comparison between an alike concept of Emergency Accident Alert (EAA) where one example involves mostly software development while the other one implicates a real-implemented system develop for automotive company.

2.1 Technology

From the Greek word *logos,* there exist the word '*–ology'* from technology where it is normally translated as word but in a simpler form, it often means "the study of" (Spyker, 2007). Lapatin (2008) mentioned that *'technikos'* also originated from ancient Greek that means skilful. Lapatin added that even '*technikos'* word is devised from '*techne',* a single word employed in the Classical Greek world to signify art, practical skill and craft. From the historical timeline we can assume that technology

is an ancient word that has been given a new breath with the advancement of digital world.

As year progress ahead, advancement in technology has made the world a better place to live in. Technology has taken a space in every earthling that lives on this planet. The benefits of technology are diverse in many sectors; educations, agriculture, research and also in medical domain. Automation in agricultural world helps farmer to save the cost of paying dozens upon dozens of workers to perform the task while in medical world, technology advancement contributes into rapid medical discoveries through the aid of machines and computers (Belcher, n.d).

With the emergence of technology, people believe that human beings are less appreciated. Professor Geoffrey Jefferson, a British neurologist and pioneering neurosurgeon, in his The argument from consciousness in 1949, "Not until a machine can write a sonnet or compose a concerto because of thoughts and emotions felt, and not by the chance fall of symbols, could we agree that machine equals brain-that is, not only write it but know that it had written it" (as cited in Fong, Poang & Shahi, 2009). They added that human is believed to be resilient and undoubtedly will search for new opportunities as human being are blessed with abilities to provide analytical insights and decision-making capabilities, thus this will ensure that no matter how advanced a technology seems to be, human will still manoeuver the workforce.

2.2 Global Positioning System (GPS)

In the early year of 1978, the first global positioning system (GPS) satellite was launched by the United States Air Force where it can be used to track any locations on the earth (Cooksey, n.d). A basic GPS receiver works when then antenna receives signal from the GPS satellites situated in the orbit and later will go through several processes to convert the received signal into readable digitize output (Tsui, 2000). Tsui (2000) further explained that after the signal had been through the hardware processes, it will then be processed by software before reaching the users as shown in Figure 2.1

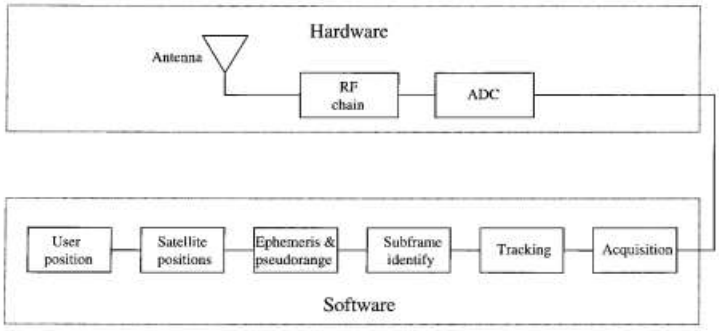


Figure 2.1 Global Positioning Components

The usage of global positioning system has reached a breakthrough where it can now be found in most of the smartphones (Boulos, Jones, Tavares & Wheeler, 2011) all across the globe. One of the most popular applications in smartphones is the navigation software. When getting into an unfamiliar location and having difficulties, those smartphones with GPS will help to identify the location and show the way out. Gordon (n.d) explained that the global positioning system will work with the built-in receiver in the smartphones to calculate a person's location based on intersection point of overlapping spheres determined and the result of intersections agreed by satellite and smartphones will be the correct location of the person.

2.3 Growth in Mobile Phone Usage

Figure 2.2: Smartphone Ownership in Asian Countries

Nielsen Smartphone Insights had done a research to investigate the percentage of smartphone ownership in Asia. The research conducted covers the developed part of Asia consisting of Hong Kong, Singapore, Malaysia and Australia as well as the developing Asia which are China, Thailand, Indonesia, India and Phillipines. Based on Figure 2.2, it can be seen that Malaysia has been ranked as the third in Asia with the top highest percentage of owning a smartphone with 80% user (Phadke, 2013). Hong Kong leads the chart by having 87% of smartphones user similar to Singapore. This shows that Malaysia have a high smart phone penetration.

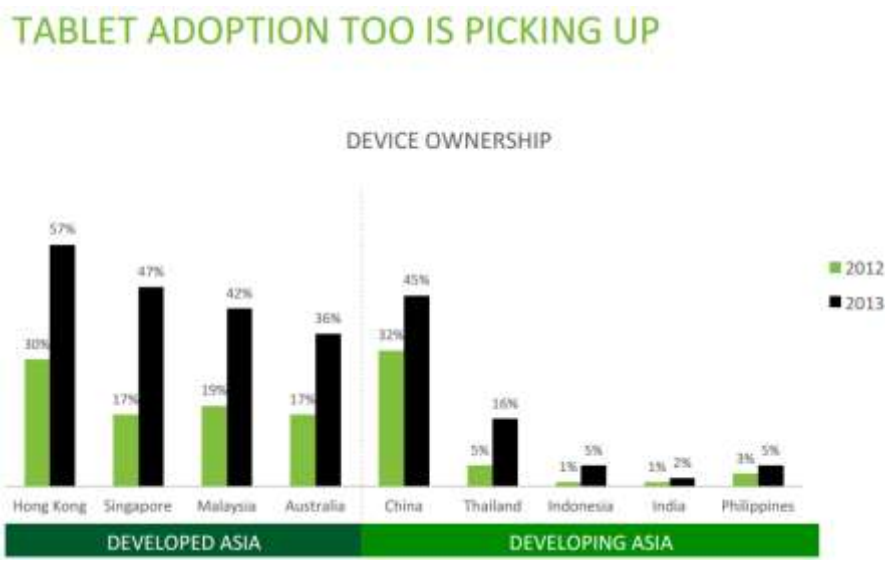


Figure 2.3: Tablet Ownership in Asian Countries

Other than smartphones, tablet; which is also a touch-screen mobile phone but with a slightly bigger than normal size smartphone, is also taken places in Asia. Figure 2.3 above compares the percentage of tablet adoption between the year 2012 and 2013. It can be seen that Malaysia shows high rise in the device ownership where it spike up from 19% in 2012 to 42% in 2013; a difference of 23% in a year (Phadke, 2013). Singapore on the other hand is also picking up fast with a difference of 30% within one year.

There are many reasons behind the sharp increase in the percentage of Malaysian citizen who choose to buy smartphones. Rahim (2013) said that the main reason for Malaysian citizen to purchase a smartphone is to be able to get an access to Internet connection besides keeping in touch with other people (as cited in The Sun Daily, 2013). The Head of Ericsson Consumer Lab for Southeast Asia and Oceania added that the growth in mobile data services are primarily for the purpose of instant messaging, social networking and video streaming.

Based on an analysis conducted by Ericsson ConsumerLab, the word-of-mouth, curiosity and the app's functionality itself drives the user to download new apps. The statistics by Ericsson had shown that the usage of usage at least once a week had reach 76% (as cited in Goh, 2013). The positive increase in apps usage shows that mobile apps have become a demand in society. There are many types of mobile applications that can be found either via purchasing or free download.

2.4 Cloud Database

With 10 or more persons employed, 97% the European Union (EU) companies have proven that they are using cloud computing services in 2014 (Giannakouris & Smihily, 2014). In addition to that research, Giannakouris and Smihily (2014) added that almost half of the EU companies (46%) usage is directed for the purpose of financial and software applications while 19% of those firms mostly used it for hosting e-mails and storing files in an electronic form.

Figure 2.4: Purpose of using cloud database

Based on the research done by Cloudability (refer Figure 2.4) a Portland upstart that helps firms to be notified on the amount of spending made across various cloud computing services (Soper, 2013), it is said that 3200 companies in 80 countries use 83% of their cloud for the purpose of hosting and computing, the 'first-runner up' cloud usage is for storage with 72% while the least on the rank is crowdsourcing which occupies only 14% of the usage (Kelly, 2012). It can be seen that companies requires cloud database to store information electronically.

It has been a wonder how this digital storage may be able to help to give advantages to people in today's world? The sunny side of the cloud that has been suggested by Hofmann and Woods (2010) is that this technology helps company in terms of cutting down underutilized infrastructure and capital expenses. Besides, the IT resources that are no longer required by the company may be released as it is based on pay-as-you-go model (Hoffman & Woods, 2010). Kavitha and Subashini (2011)

support the statement of pay-as-you-go model concept where cloud service provider offers scalable storage, pay-for-use, and rapid accessibility to storage from any locations (As cited in AlZain, Pardede, Soh & Thom, 2012).

Living in a digitalize world, one is always exposed to the threat of information being barge by unscrupulous people. AlZain et al. (2012) addressed the issues of threat in cloud database where the database itself has been built over the Internet and any possible risks that occur over the Internet especially security risk, may still affect the cloud database. Besides the security barging, cloud database is also subjected to performance instability. In a stress test conducted by Sydney-based researchers found that well-known cloud services offered by Amazon, Google and Microsoft experienced a regular performance and availability issues (Winterford, 2009). Despite the hassle of receiving 2000 concurrent users accessing the cloud database, the vendors managed to prove their claims on "perceived infinite scalability".

2.5 Related works

2.5.1 Technology for Emergency Responder: WreckWatch Vs OnStar

Applications related to medical fields are in the state of growing. Dougherty, Schmidt, Thompson, Turner and White (2011) suggested creating a mobile app in order to lessen the time for the emergency responder to attend to the accident, traffic accident detection and notification apps using a smartphone. The apps works through the functions of accelerometers and acoustic data that are able to detect when an accident occur that involves the owner and a central emergency dispatch server will be notify after that accident (Dougherty et al., 2011). A mobile application called WreckWatch is develop as being suggested.

Previously, before the idea of having a mobile application that can detect an accident, there is a system embedded in a car called OnStar Automatic Crash Response that works with similar concept as the mobile application. Whenever a crash occurs, the built-in sensors inside the owner's car will alert a system called the OnStar Advisor and the vehicle will be automatically connected to the Advisor to check the condition of the car without the owner moving a single part of his body (OnStar, n.d). Boushek, Klimek and Nitz (2006) added that in the circumstances that a crash occur that causes the airbag of the car to be force open, the General Motor's OnStar system will be trigger and call for assistance.

Comparing the idea and invention of the system, it can be seen that both have its own advantages and drawbacks. The WreckWatch clear advantage is that it is implemented inside an Android OS mobile phone where the user will be bringing it anywhere. On the other hand, OnStar is a system implemented in GM cars only for instance Chevrolet, Buick, GMC and Cadillac where the cost is obviously a bit expensive compare to buying a phone. However, the drawback of both ideas is that if the user did not bring along the mobile phone, it will be pointless and for OnStar, not all cars have this system implemented.

Loureiro et al. (2013), discussed that among the current useful systems or medium that are able to provide a treasured information regarding a real-time events are Foursquare, Instagram, Weddar and Waze. Using almost similar concept as Waze and Instagram, WreckWatch allows the bystander to become "citizen scientists" through the help of capturing photos at crime scene and upload it either to WreckWatch or send it to ERT team (Dougherty et al., 2011). This in return will help other road users to re-route their journey besides helping the ERT team to know the scene based on GPS data.

2.5.2 Technology in Medical World

2.5.2.1 mUAHealth

The invention of Personal Digital Assistants or well-known as PDA, have help many healthcare people in terms of organizing contacts and calendars. With its capability of carrying laboratory values and information about diseases, the usage of PDA is predicted to grow exponentially (Wiggins, 2004). However, the growth of PDA was obstructed by the development of another device called smartphones where it is a new technology that integrates communication and computation in a handheld-size (Mosa, Sheets & Yoo, 2012). Ventola (2014) supported the facts by saying that there are many healthcare professionals who are now a smartphones or tables user where these devices combine the functionality of pager, cellphone and PDA to perform their task.

Figure 2.5: Architecture of mUAHealth.

The increase in awareness about the importance of health had induce to the creation of mUAHealth systems (refer Figure 2.5) where it is actually a mobile applications integrated with health monitoring system to monitor the wellbeing of a human physical activities, heart conditions and also the weight (Jovanov, Miloševiæ & Shrove, 2011). In their research, Jovanov et al. (2011) added that in addressing the issue of the needs to send health information when there is no Internet connection, mUAHealth is designed to work in both online and offline connection as user does not typically perform exercise near an active Internet connectivity. mUAHealth have its own local and remote database to know when to submit health related info to medical server when there is Internet connectivity.

2.5.2.2 Personal Heart Monitoring and Rehabilitation System

Datin Dr Liew Yin Mei, medical director of the Heart Foundation of Malaysia said that "We only have one heart. It is the powerhouse, the centre, and the battery of the human body. You can lose an eye, a limb, but once you 'lose' your heart, you're gone" (Ho, 2013). It is very important for each and every one should be taking good care of the heart. Gay and Leijdekkers (2006) research had come up with a personal heart monitoring system using smart phones has been developed to detect heart threatening disease.

To aid this system, patient details had been taken by cardiologist and cardiac conditions of the patient is taken as an input into the system. The patient is needed to wear an ECG sensor everywhere to measure the patient's blood pressure and weight few times a day. When the patient is struck by a strong pain in the chest, the

smartphone will automatically activated and will play a loud message to notify the patient.

If it is a false alarm regarding the patient's health, then the patient will be able to switch it off. But under the circumstances that the patient passed out, the smartphone will automatically dials emergency number and plays a recorded message stating the patients name, the emergency and the current location. Should there be any bystanders, they will be able to play a crucial role by listening to the first aid instructions played by the smartphones. Figure 2.6 below shows the architecture of the Personal Heart Monitoring and Rehabilitation System.

Figure 2.6: Architecture of Personal Heart Monitoring and Rehabilitation System using Smart Phones

2.6 Usability Principles

Shackel (1991) defined usability as "the capability in human functional terms for a system to be used easily and effectively by the specified range of users, given specified training and user support, to fulfil the specified range of tasks, within the specified range of scenarios" (as cited in Inostroza & Rusu, 2014).

It is crucial for any electronic applications to have criteria that eases user to use the applications. Developed by Jakob Nielsen together with Rolf Molich in the early 90's, the usability heuristics continue to be a guideline for system and application developer to create interfaces that facilitates user in using it.

From Inostroza and Rusu (2014), the principles are:

1. **Visibility of System Status**

   The user will be kept updated regarding any state changes and all processes through feedback and in a reasonable time.

2. **Match between System and the Real World**

   The system shall follow the real world conventions by displaying information in a logical order to ease the user. Besides, the system should be able to speak the user's language rather than using system-oriented concepts and technicalities.

3. **User Control and Freedom**

   Through the availability of undo and redo button, user will be at ease when they intended to leave an unwanted state in the system. It is preferable to have the "emergency exits" through physical button or anything similar.

4. **Consistency and Standards**

   By having established conventions, system will allow user to feel familiarize with the ways of performing actions on a particular system through standard and consistent way.

5. **Error Prevention**

   The system should hide or deactivate any unavailable functionality besides warning users about critical actions and allowing user to access additional information crucial to the knowledge of user.

6. **Recognition rather than Recall**

   A usable system should offer user visible objects, actions and options as to minimize at its lowest the things that user needs to memorize.

7. **Flexibility and Efficiency of Use**

   The system shall increase its efficiency through the ability to load and display required information to user within a reasonable time. Besides, the

amount of steps required to perform a particular task should be minimize. Any animations or transitions should be displayed in a smooth manner.

8. **Aesthetic and Minimalist Design**

   In a defined context of use, it would be necessary for the system to avoid displaying unwanted information to user.

9. **Help Users Recognize, diagnose and Recover from Errors**

   The ability to display error message in familiar language to user will ease them into understanding the issue better and to help suggest a constructive solution for user to follow.

10. **Help and Documentation**

    By providing an easy-to-find documentation and help, user will have the tendency to be at ease as the documentation will provide concrete steps to follow.

2.7 Issues of False Calls in Malaysia

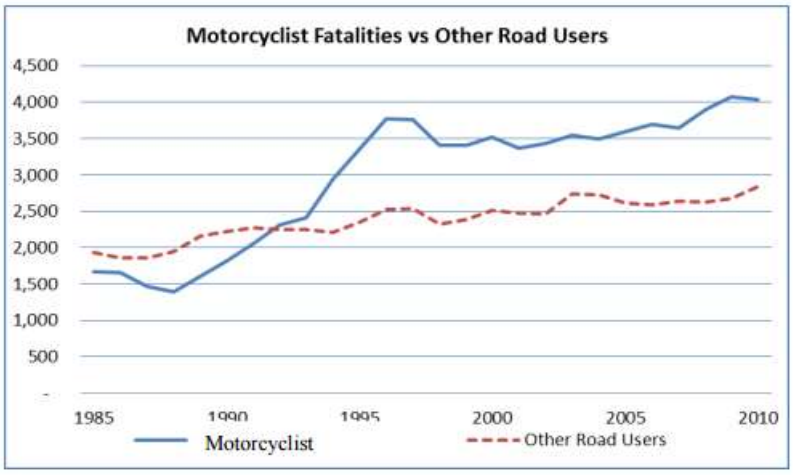


Figure 2.7: Motorcyclist Fatalities Rate vs Other Road Users

Based on Figure 2.7 above, it can be seen that the rate of fatalities in motorcyclist is much higher than any other road users. Malaysian Institute of Road Safety Research (2011) suggested that the reason behind there are many road casualties involving

motorcyclist is due to the convenience and affordability features that motorcycle has compare to other mean of transportations.

Schoettle (2014) stated that Malaysia have been top the 17th most dangerous roads (as cited by Murad, 2014). He added that University of Michigan research conclude that out of 100,000 individuals, there exist 30 fatalities. As a development increase in a particular nation, so does the road fatalities said Schoettle, pointing to India and China as an example.

"..a matter of just three minutes can mean life or dead" said Malaysian Minister of Communication and Multimedia, Datuk Shabery Cheek. He added that Malaysia Emergency Response Services (MERS) 999 receives approximately an average of 83,000 calls per day and devastatingly only 2.3% are genuine (As cited in Bernama, 2014). According to Section 233 of Communications and Multimedia Act 1998, if a person was found guilty to be abusing the 999 emergency calls in Malaysia, the person might be fines RM50, 000 or jailed not more than one (1) year or both if was found guilty. The issue of false call is very serious in Malaysia as it may put other people's life at stake due to the emergency operator attending false calls and not the genuine one.

2.8 Reflections

The increasing rate of fatalities in road users is at a worried state when Malaysia itself have been numbered top 17th for its dangerous roads. Some of the road crashes victims may have a chance of living if and only if the paramedic arrives in fast manners. However, due to several false calls made by irresponsible culprits the act of saving the victim's life had been delayed.

Xiong (2014) stated that the current method that is being applied by the emergency response team is the "scoop-and-run" method where the patient or the victim will be transported immediately to the hospital. He added that only upon the arrival of the patient at the hospital is the only time when the decision for further treatment is made and the emergency response team are the people in-charged to fill in the personal details and medical condition of the patients.

Technology played an important role in this situation where the creations of OnStar system that has been equipped inside vehicles that function to call the paramedic team upon accident. Besides a build-in system, a downloadable version of mobile application called WreckWatch has also been created that has almost similar functions with OnStar. With the emerging digital science world, it seems that life-saving becomes much easier.

CHAPTER 3

METHODOLOGIES

3. Introduction

In this chapter the methodologies used are describe from requirement elicitation process to the methods of developing the system. The first section will elaborates on the phases involve in developing the Emergency Accident Alert (EAA). The second section will describe the system architecture. The third section will state the limitation and assumptions during the conduct of the methodologies. The fourth section is the type of model used to perform the development of the prototype

3.1 Project Activities

There are four phases involved for the development of EAA.

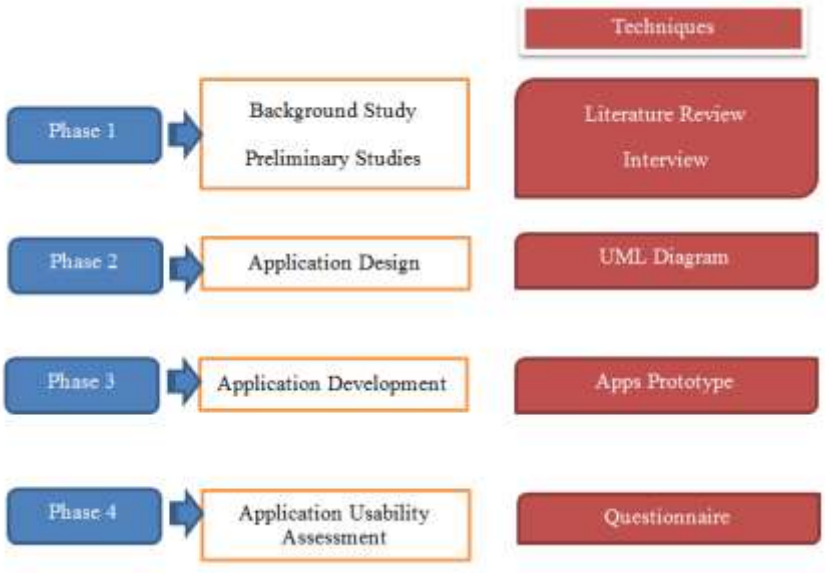


Figure 3.1: Phases involved in the development of system

3.1.1 Phase 1

For the first phase, there is a need to perform some research for background studies to know more about the importance and objectives of having EAA. In order to capture the information, a read-through research papers is crucial to create a literature review and conducting interview with the EMS.

The preliminary studies of EAA project will employ an interview technique where the data will be obtained from the employee of the hospital. This research design is suitable to be used since the application is develop to suit both public user and emergency call operator to ease notifications to be made straight to the emergency call headquarter in precise and concise manner. During the process of collecting data, there will be an interaction with the hospital employees which enables a clearer understanding of the correct flow during an emergency call in a hospital.

The sample frame that will be used for this research is the employee of a hospital in Penang. The research focusses on looking at the flow of information during an emergency call and to evaluate the effectiveness of using a mobile application to enhance the reliability and accuracy of transmitting information straight to hospital through emergency call headquarter.

3.1.2 Phase 2

The second phase is the time where the designing of the application will be performed. The development of UML diagram such as the use case and activity diagram is crucial to ensure the correct flow of the required functions of the system.

3.1.3 Phase 3

The third phase is the development of the application where the coding will take place in the system. This part is crucial as it involves integrating several functions outside the application such as the cloud database. A prototype of the system will be the output of this phase.

3.1.4 Phase 4

The last phase is where the testing will be performing to assess the level of usability of the Emergency Accident Alert (EAA). A set of questionnaires will be distributed to the public people to acquire their usability testing feedbacks after using EAA. Reason wise of making public people response as part of data gathering is to understand more of the people's need as they are the important user of this mobile application. The benefits of disseminating online questionnaire is to cover a wide coverage of response from many people in less time

3.2 System Architecture

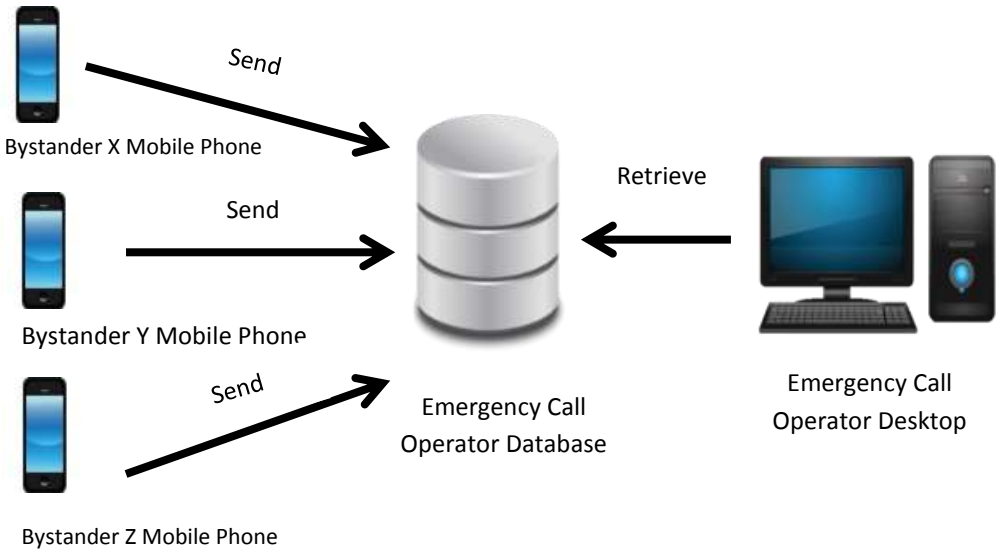


Figure 3.2: System Architecture of Emergency Accident Alert

The mobile application system is a downloadable version from internet. The bystanders may download the application and used it when an accident occur that needs immediate information to be communicated to the operator. The system incorporates the role of user until the emergency operator. Anyone who has the application will send the details of victim and the accident to where the information will be store in the Emergency Call Operator Database. The Emergency Call Operator will be able to retrieve the information and view it in the desktop where it

will then be the operator's responsibility to send further assistance to the victim accordingly.

3.3 Limitations and Assumptions

There are several assumptions before the interview has been conducted and limitations after the interview has been done.

Before conducting the interview, it is assume that all information regarding an accident can be send straight to the hospital according to the nearest distance from the accident scene to the hospital. However, after successfully conducted the interview, the appropriate flow will be in such a way that all information should be communicated to the emergency call operator. With the emergency call operator authority, the task of attending to the accident scene will be given by the operator to the hospital.

3.4 Rapid Application Development (RAD)

For the development of EAA project, Rapid Application Development model will be used. Since this project focusses on developing a mobile application, an early prototyping method will help to portray the functions of the system. A prototype is basically a working model resembling the actual product.

Elements that make RAD better than SDLC varies according to type of project that a particular team intended to do. This mobile application project is required to be completed within months thus RAD is a better choice as RAD focusses more in iterative and incremental delivery working models that may deliver a rapid product development to customer. Furthermore, RAD are suitable to be implemented to project that has clear modularization and EAA project are divided into few different components that requires different functionality such as Global Positioning System (GPS), cloud database, retrieving information from database and other related functionalities.

One of the early founders, James Martin approach of RAD methodology comprises of 4 distinct phases:

3.4.1 Requirements Planning Phases

At the beginning of a project, the project scope, business needs, constraints and system requirements are essential to determine the success of the project. The information and requirements are gathered through the interviewing process held at Lam Wah Ee Hospital in Penang. Acquiring information about the correct procedure flows during an emergency call provides an additional help in the next phase.

3.4.2 User Design Phase

Based on the data obtained, the design of the prototype will be develop in which it will allow the user of the system to be able to interact with the system. The flow of how the system works with user interaction will be portrayed in sample screenshots and procedures.

3.4.3 Construction Phase

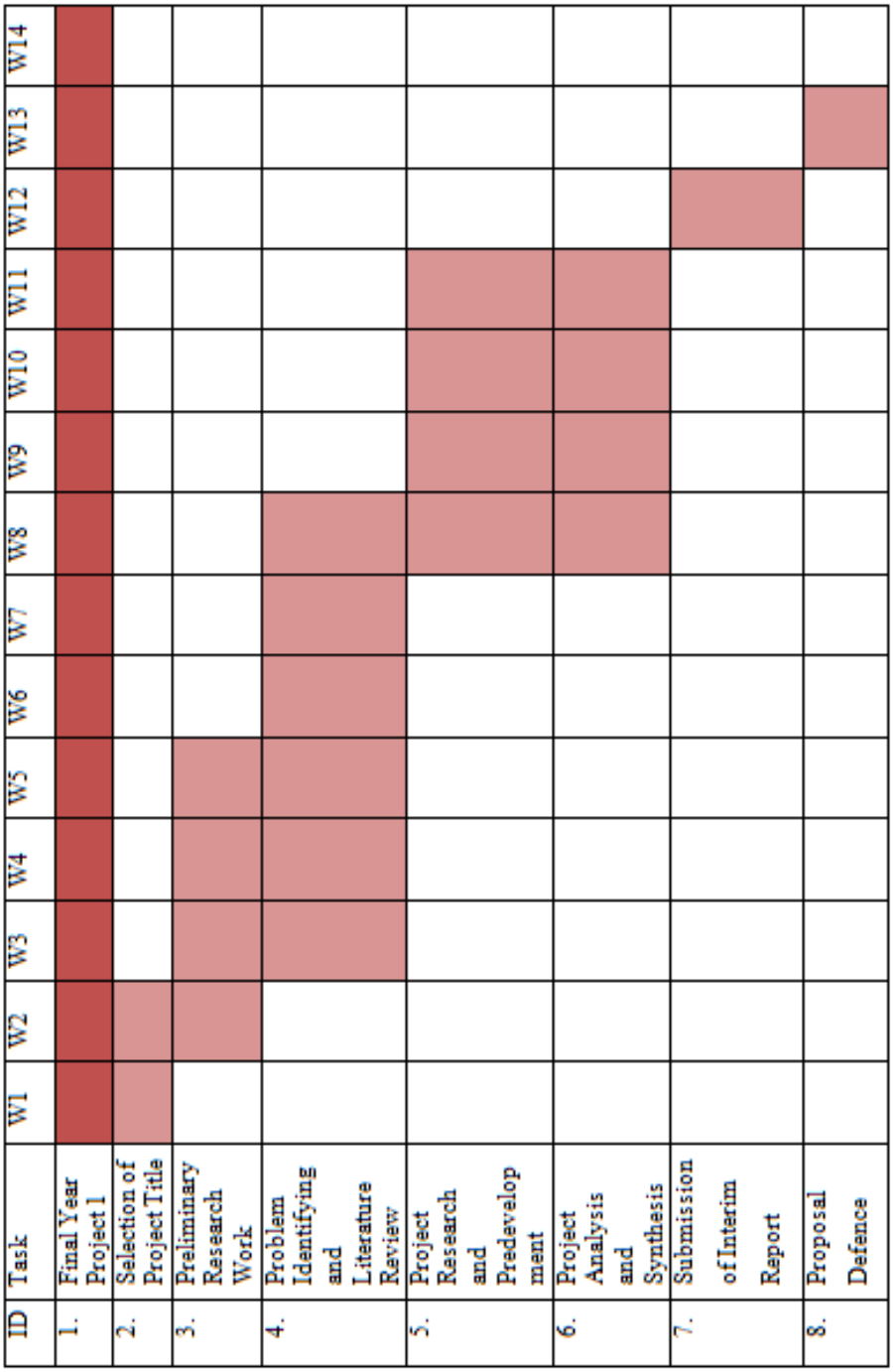
By having all the requirements and designs ready, the development process of the EAA prototype will commence. Besides having the real code working, it is crucial to ensure that the mobile application is accepted by user thus a usability testing will be required to confirm it.

3.4.4 Cutover Phase

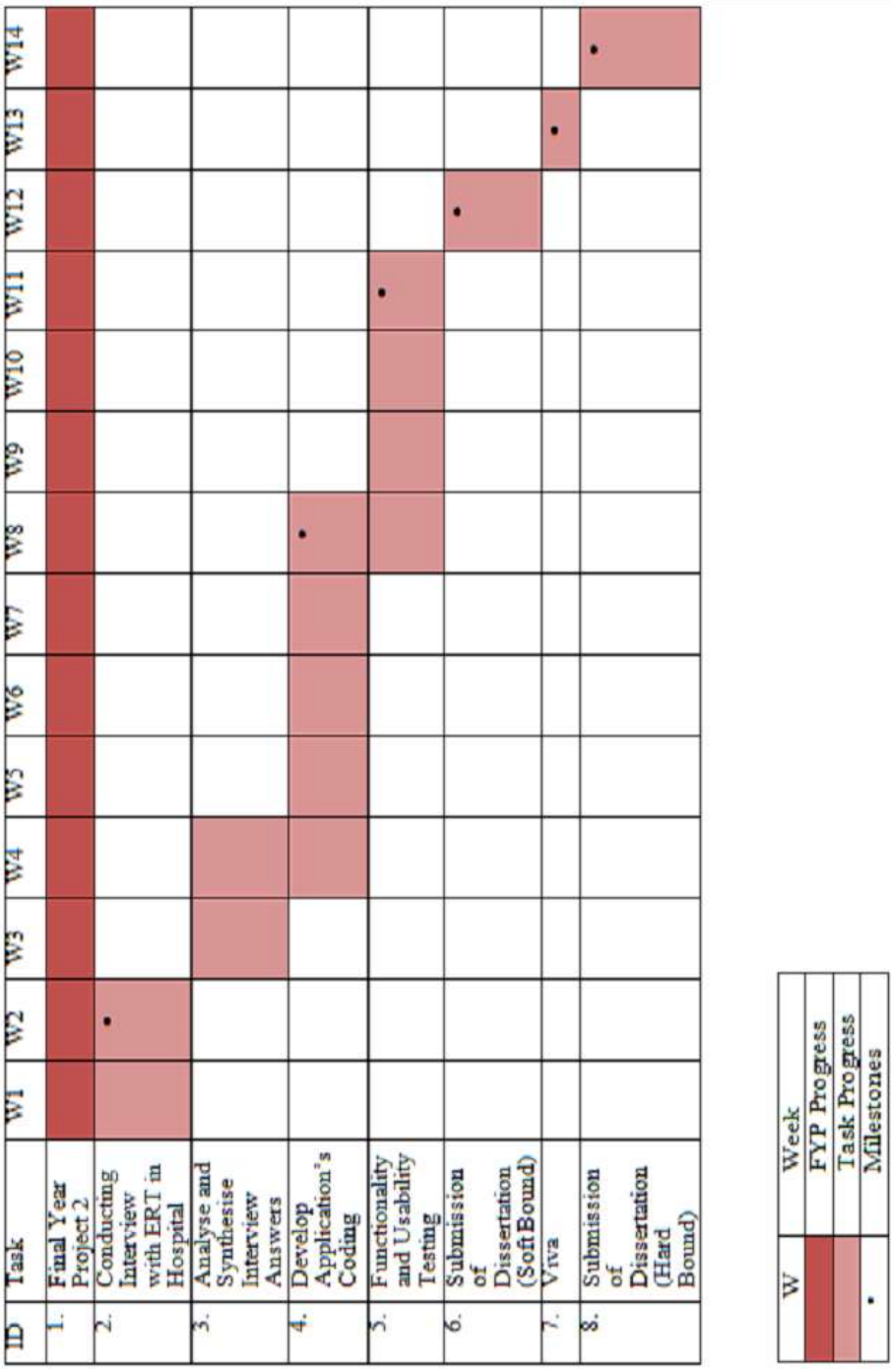
At the client site, the system will be installed and usability testing shall be conducted. Training on how to user may use the system will also be provided.

3.5 Gantt Chart and Key Project Milestone

3.5.1 Final Year Project 1 [January 2015 Semester]



3.5.2 Final Year Project 2 [May 2015 Semester]



CHAPTER 4

RESULTS AND DISCUSSION

4. Introduction

The first section of result and discussion will depicts the flow of the system through UML diagram. The second section of this chapter will portray the screenshot of Emergency Accident Alert mobile application prototype which was developed during second phase of final year project 2.

4.1 System Flow

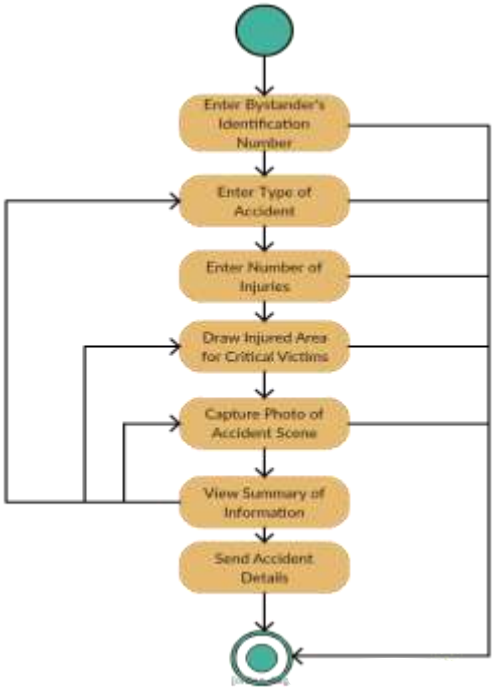


Figure 4.1: Activity Diagram of Emergency Accident Alert

Figure 4.1 illustrates the activity diagram of Emergency Accident Alert mobile application. The first activity that user will come across after starting up the app is the Entering user details where user are compulsory to enter their identification details; either National Registration Identity Card (NRIC) number for Malaysian, or passport number for non-Malaysian.

Upon the completion of the first activity, user will be directed to the second and third activities prompting user to enter type of accident and the number of injuries that occur in the accident. The fourth activity is to allow user to draw the injured area of the victim whenever necessary. The drawing is only restricted to critical victims only. Next activity will prompt user to capture the photo of the accident scene and lastly, user need to finish the task by send the accident details.

For every activity, user is given the privileged to return to the desired activity to make any amendments. Should the user wanted to stop the flow of the activity, user is allowed to exit the application anytime the user desired.

4.2 System Use Case

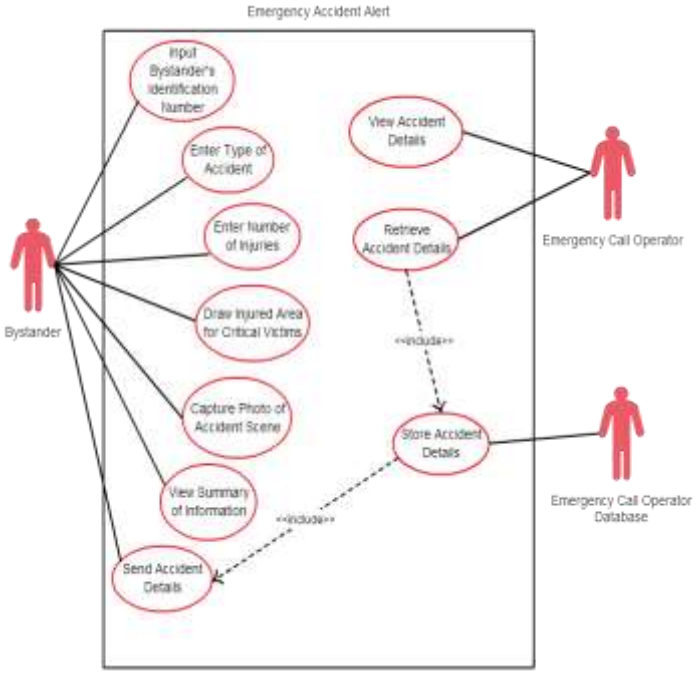


Figure 4.2: Use Case Diagram of Emergency Accident Alert

Figure 4.2 demonstrates the interaction between the actors for Emergency Accident Alert (EAA) mobile application. In the use case diagram above, there will be three actors involved which are the Bystander, Emergency Call Operator Database (which represents a database system) and Emergency Call Operator (ECO). The Bystanders are anyone who own a smartphone as this mobile application will only work in smartphones. The activities that can be done by the bystanders are similar to everything inside the activity diagram of EAA (refer Figure 4.1). The Emergency Call Operator Database (ECOD) primary and sole function is to store all the accident details sent by the bystanders inside the database. In order for the database to works, it is dependent on the last activity of the bystander; which is to send the accident details.

ECO on the other hand is the person in charge to view the accident details before deciding to segregate and forward the accident location to hospital nearby the accident scene. To view all the details, ECO needs to retrieve the information stored in ECOD, thus it is crucial for ECOD to works.

4.3 Emergency Accident Alert Mobile Application Interfaces

4.3.1 Main Screen

Figure 4.3: Screenshot of Main Screen

Upon clicking the mobile application icon in the smartphone, user will see the interface which is the Main Screen. To proceed, user needs to click on the “Save Lives Now” button in blue.

4.3.2 Authentication Screen

Figure 4.4: Screenshot of Authentication Screen

The next screen will be the Authentication screen where user is required to type in their NRIC or passport number in the text field provided.

4.3.3 Help Button Information

Figure 4.5: Screenshot of Information displayed when Help Button is pressed

Whenever the user is not sure on what to select or what action should be perform, user can choose to click on the “Help” button. In every page except the Submission page, there will be a “Help” button on the right side of the screen to guide user in providing inputs into the application.

4.3.4 Error Alert

Figure 4.6: Screenshot of Information displayed when user leave the text field empty

Error alert will appear at the screen whenever user enters information wrongly or leaving certain text field empty

4.3.5 Accident Details Screen

Figure 4.7: Screenshots of Accident Details Screen

The content of the Accident Details page are divided into two; type of accident and number of victims according to gender. For the first section, user are required to select the type of accident that occur and for prototyping purpose, it is assume that

there are only four types of vehicles that involve; car, motorcycle, bus and lorry. It is also assumed that the crash only occur between two types of vehicles.

For the second section, user is needed to identify the injured victims based on gender. Should there be no injuries related to the specific gender or age category, user may choose zero. User should also distinguish between adult and children that suffer injuries. This information is crucial on the hospital side as they need to prepare necessary equipment to be brought along inside the ambulance.

4.3.6 Victim's Conditions Screen

Figure 4.8: Screenshot of Victim's Conditions Screen

On this page, user is required to select the number of victims in three states; critical, moderate and minor based on user's observation on the number of victims injured. The drawing canvas will appear specifically based on the input given by user. Based on Figure 4.8, if the user select one victim that is in a critical condition, the number of drawing canvas will appear is also one. Should the user choose three, then there will be three canvas displays. User then needs to draw the area of which the victim injured the most. The Identification Card number text field can only be filled if and only if the critical victim's IC number is visible to user's view.

4.3.7 Scene Photo Screen

Figure 4.9: Screenshot of Scene Photo Screen

This page requires user to snap a photo of the accident scene. The photo can be obtain two ways; either through clicking the "Capture Photo" button where it connects to user's camera or by clicking the "Choose From Photo Library" button where user is allowed to select the accident scene photos from the user's image library (if user has already snapping the photo earlier).

4.3.8 Submission Screen

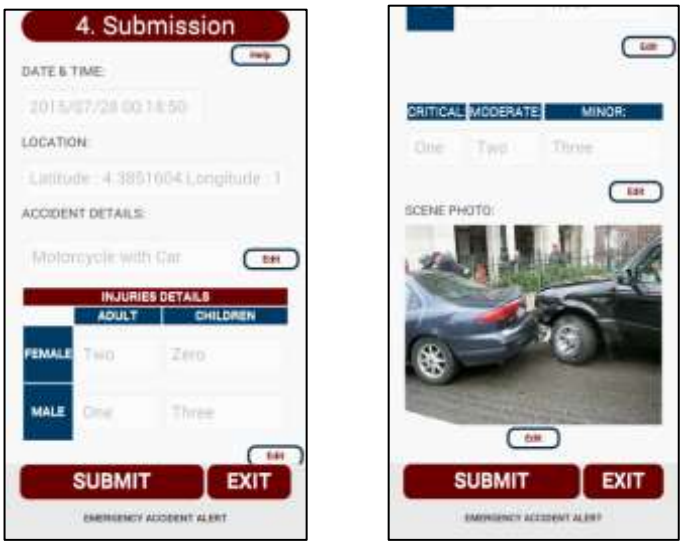


Figure 4.10: Screenshot of Summary Screen

Figure 4.10 shows the summary of the information entered by user earlier. Some information might not be visible at this page as this page only displays important

details. The remaining information such as the Identification Card number or passport number of user and the areas of injuries drawn will still be sent to the ECOD and will be viewed by ECO upon clicking on the “Submit” button. Should the user wanted to return to a specific page to alter the information, it can be done by clicking on the “Edit” button at every section (except date, time and location section).

4.3.9 Submission Completion Alert

Figure 4.11: Screenshot of Alert indicating the Submission Process has completed

After clicking on the “Submit” button, user will be notified by the pop-up alert on the screen indicating that the information entered by user has successfully being send to ECOD and will be retrieve by ECO on their desktop view.

4.3.10 Emergency Call Operator’s Desktop View

Figure 4.12: Screenshot of ECO Desktop View

The emergency call operator will retrieve the information and will be able to view in the operator's desktop.

4.4 Usability Testing Questionnaires

Performing usability test marks the completion of the third objective in this final year project. The testing was done by several users and a set of 16 questions was given to the user to be filled on the spot via Google Spreadsheet. Users are required to select the answer based on the Likert Scale; starting from 1 which represents Strongly Disagree, 2 representing Disagree, 3 representing neither Agree nor Disagree, 4 representing Agree and finally Strongly Agree is represented by digit 5. The questionnaires are based on the 10 usability principles by Jacob Nielsen:

4.4.1 Visibility of system status.

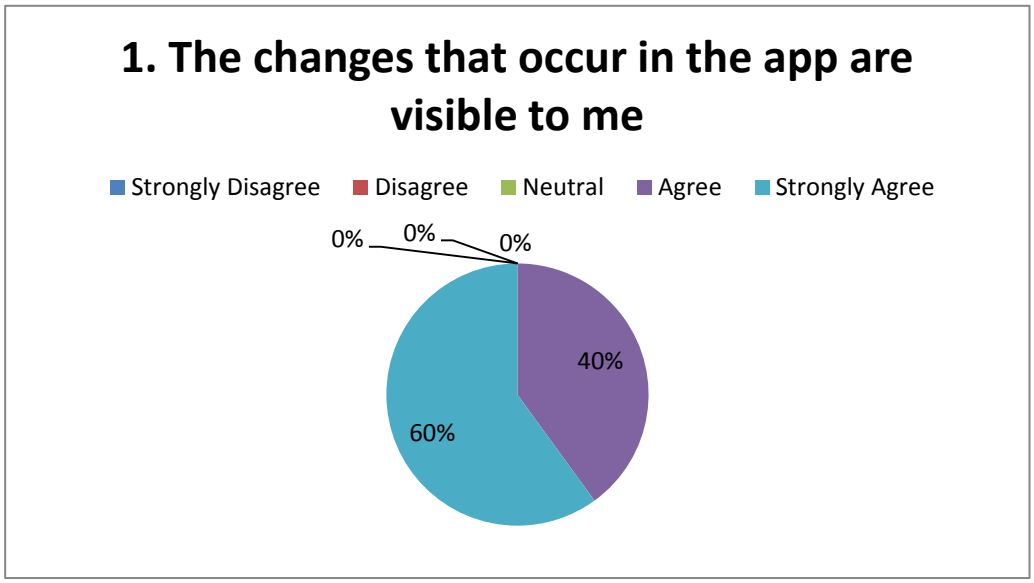


Figure 4.13: Questionnaire 1

This question is asking the user whether the user is able to see the changes that occur in the application especially after user clicks on the button. 40% of the user agrees and the remaining 60% stated strongly agree. This indicates that the transition from one page to another and alert that is displayed can be seen by user.

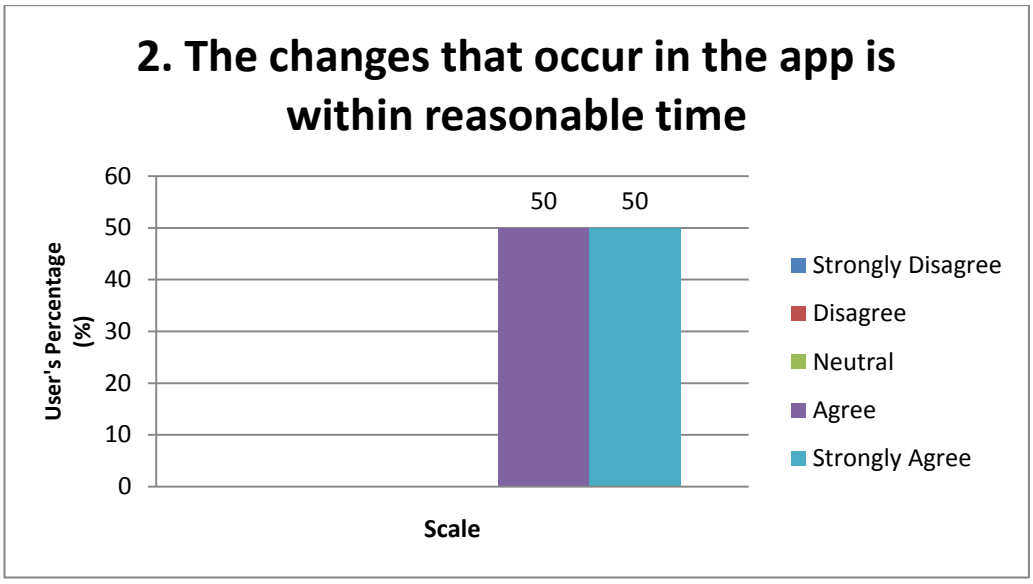


Figure 4.14: Questionnaire 2

Under the same usability principle, this question is asking whether the changes that occur in the app are within reasonable time. This question is basically linked to the previous question. User seems to agree as similar result obtains on both Agree and Strongly Agree scale. This indicates that all users are satisfied with the time taken for the application to perform changes.

4.4.2 Match between System in Real World

The second usability principle is on the "Match between Systems in Real World". Under this principle, 3 sets of questions are being asked.

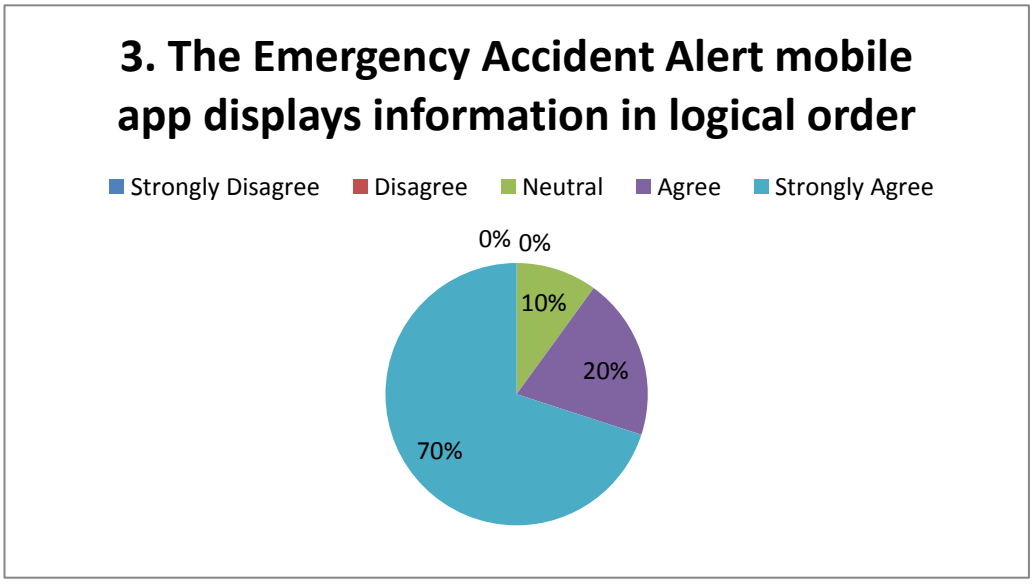


Figure 4.15: Questionnaire 3

This question is asking whether the mobile application displays information in a logical order. The question asked is intended to assess whether the pages arranged in the application are in such a way that it is in proper order. For this question, the respond seems to be a bit deviate from the previous two. 10% of the respondents had chosen 3. While the remaining 20% and 70% selected Agree and Strongly Agree respectively. It is assume that 10% of the user experience confusion with regard to the question asked.

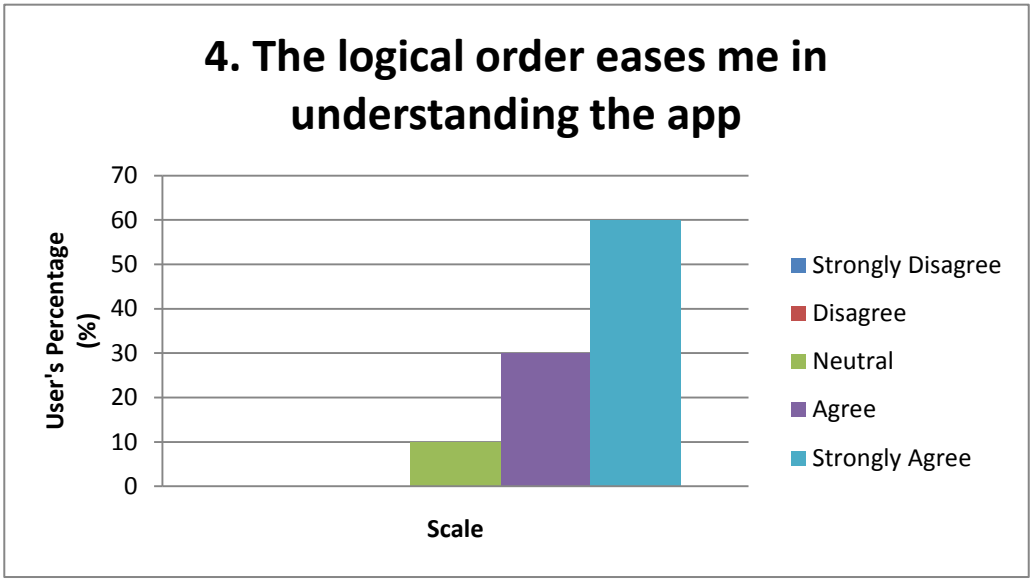


Figure 4.16: Questionnaire 4

The above question is to assess whether the logical order of information portrayed in the app eases the user in understanding the mobile app. 60% of the user selected scale 5, 30% chose scale 4 and 10% are on the neither Agree nor Disagree scale 3. Since, this fourth question is directly linked to the third question; the same assumption in question 3 can be applied here.

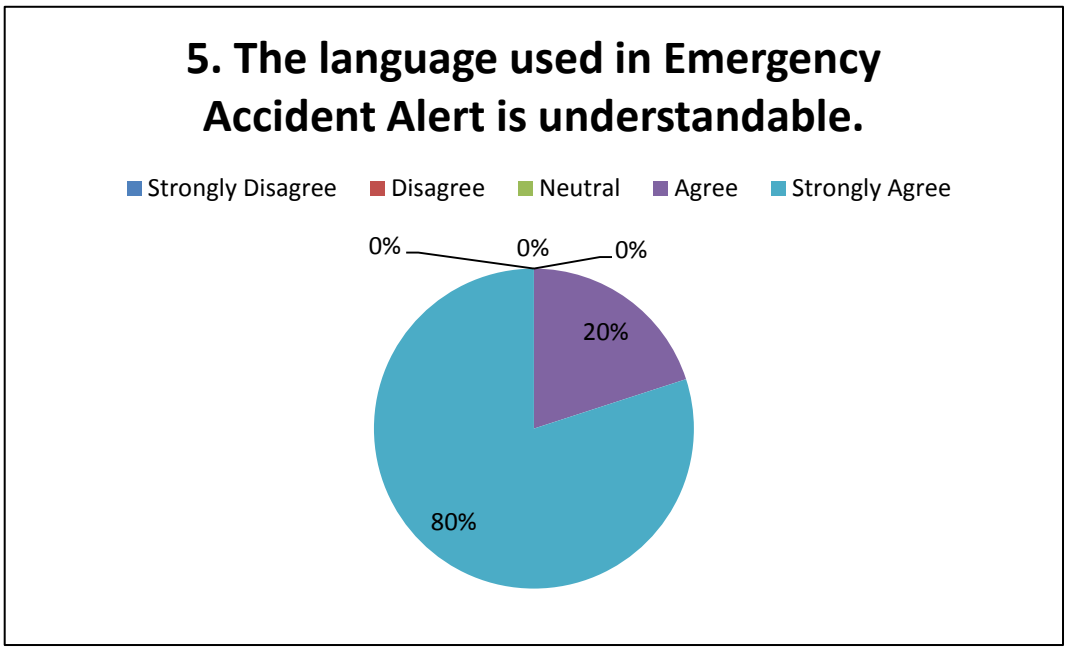


Figure 4.17: Questionnaire 5

This last question under the second usability principle category is asking whether the language used; which is English, is understandable by user. All of the users agreed on this question where 80% selected scale 5 and 20% selected scale 4.

4.4.3 User Control and Freedom

Under User Control and Freedom principle, two sets of questions had been asked.

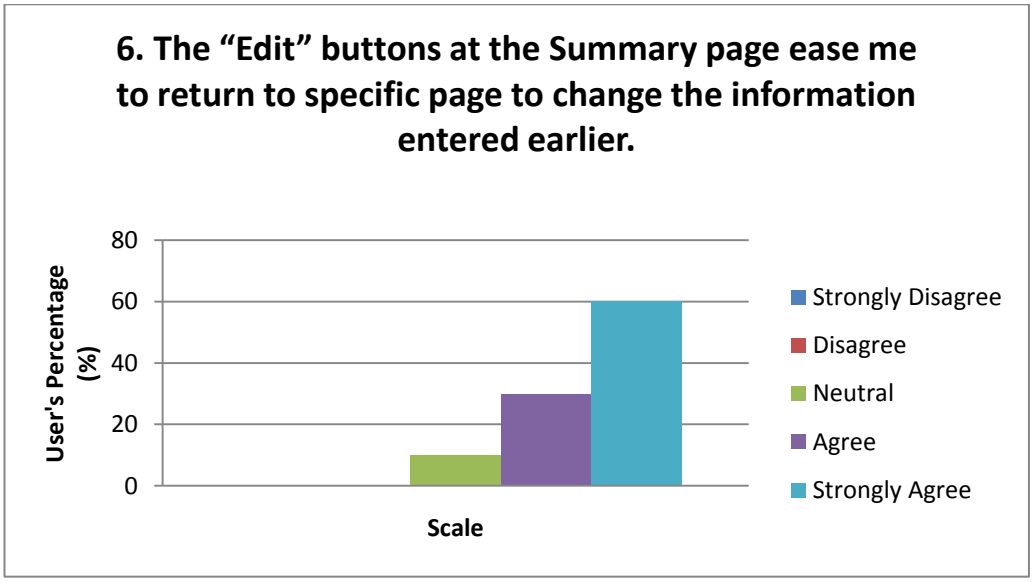


Figure 4.18: Questionnaire 6

The first question touches on the ease of having and "Edit" button at the Summary page where it allows user to return to specific page to make an amendments of the information entered earlier. 10% of the user find it indecisive in this question while 30% and 60% of the user pick scale 4 and scale 5 respectively. Possibility that 10%

of the user selected scale 3 might be due to the reason that the user did not used the "Edit" button during the testing period.

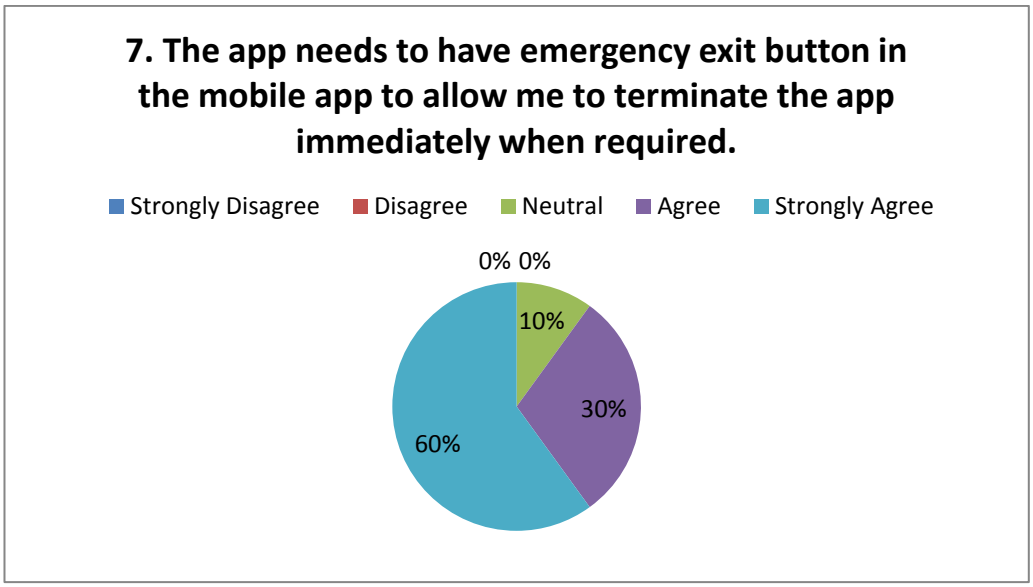


Figure 4.19: Questionnaire 7

The second question is prompting the user's opinion on whether to have an emergency exit button at every page of the mobile app to allow user to terminate the program whenever desired, without having the hassle to reach the end of the page only to exit the program. Majority of the answer encompasses of 60% of user chose scale 5 which indicate Strongly Agree and 30% of the user selected scale 4 signifying Agree. The remaining 10% selected scale 3. It can be assume that 10% of the user is neutral; by having or not having the Exit button will make any difference.

4.4.4 Consistency and Standard

The fourth Usability Principle is on Consistency and Standard. The users were asked whether the interfaces in the Emergency Accident Alert app are consistent and whether the consistency ease user in using the app.

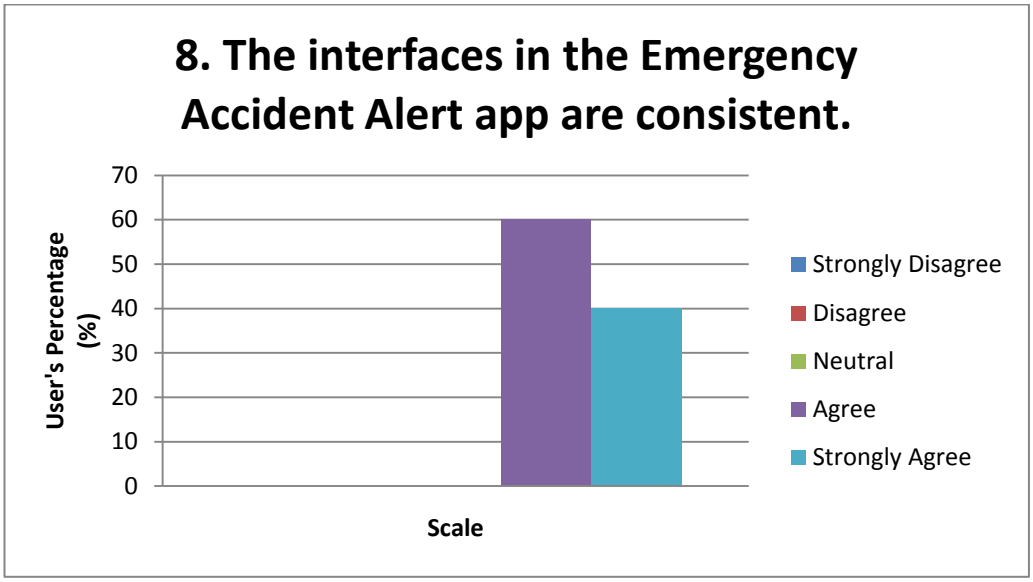


Figure 4.20: Questionnaire 8

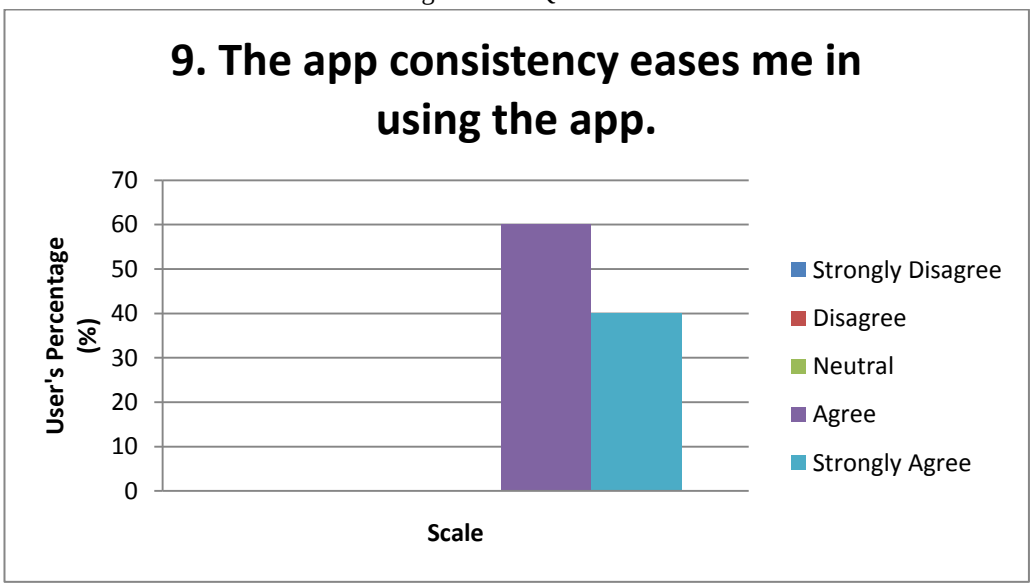


Figure 4.21: Questionnaire 9

It can be seen that the results are consistent for both question (since it is a linked question) where 60% user strongly agree that the interfaces are consistent and the consistency eases them in using the app while the remaining 40% selected agree as an answer.

4.4.5 Error Prevention

Fifth Usability Principle focuses on Error Prevention. The question asked is whether the app provides error messages or warning whenever crucial information needed are not fulfilled by user.

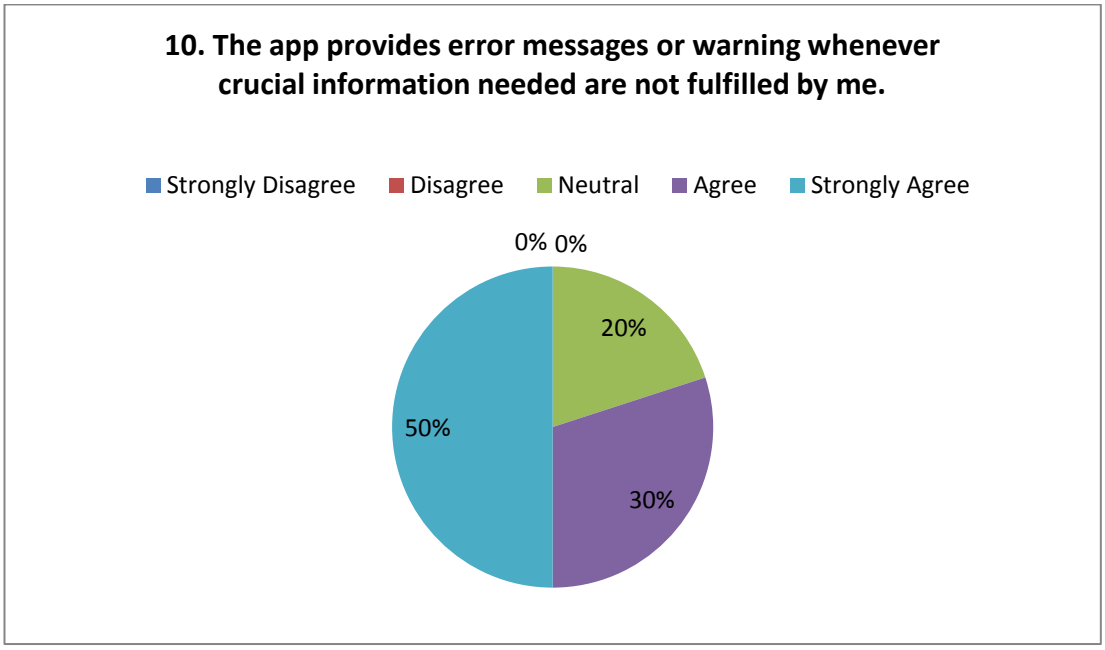


Figure 4.22: Questionnaire 10

The percentage of user selecting scale 3 is 20% while 30% and 50% of the user chose scale 4 and 5 respectively. For the 20% of the user that selected scale 3, it is assumed that the user did not experience any error message because the information had been correctly entered.

4.4.6 Recognition rather than recall

Recognition rather than recall is the sixth Usability Principle that promotes the usage of visual aids such as symbols, diagrams, image etc. that may aid user rather than using words.

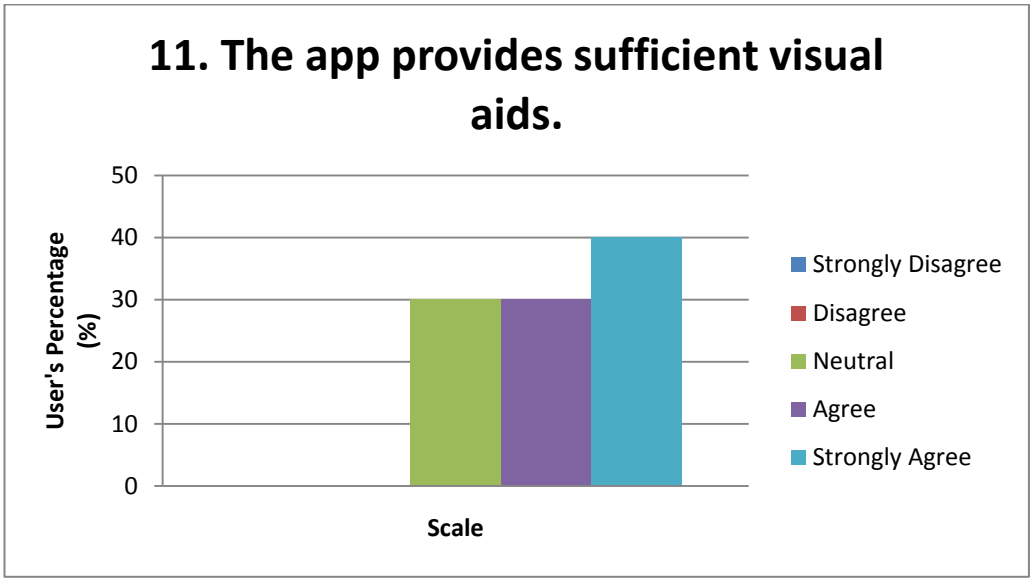


Figure 4.23: Questionnaire 11

The result for this question seems to be equal for scale 3 and 4 where 30% of users selected the scale respectively; the remaining 40% is on scale 5. This might indicate that users think that the usage of visual aids is moderate in the app.

4.4.7 Flexibility and efficiency of use

Flexibility and efficiency of use assesses the efficiency level of the mobile app. The question asked whether the steps required completing the form in the app is reasonable and not too long.

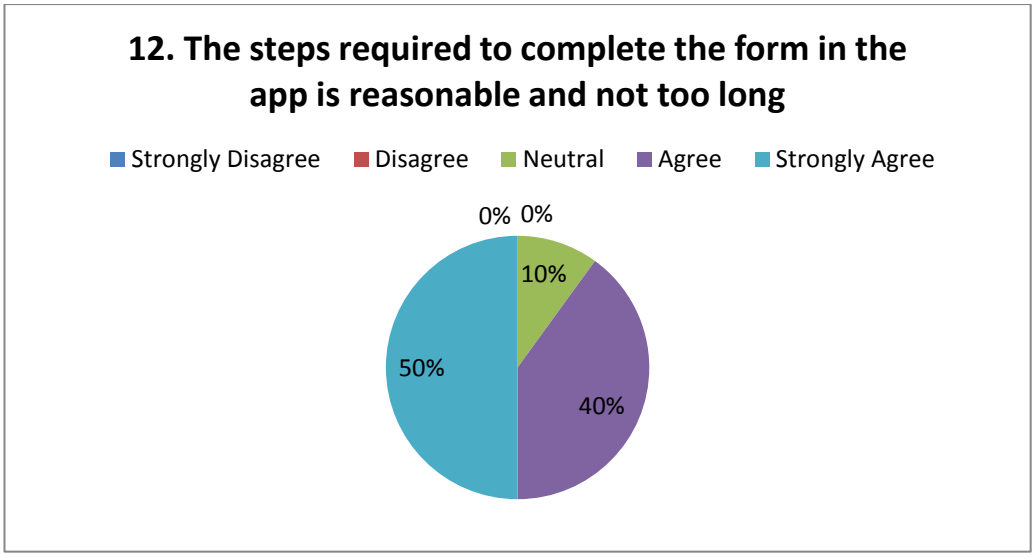


Figure 4.24: Questionnaire 12

40% and 50% of the user selected scale 4 and 5 respectively indicating that the users agree the steps to complete the process is reasonable. While the remaining 10% selected scale 3 indicating that the steps are moderate between long and short.

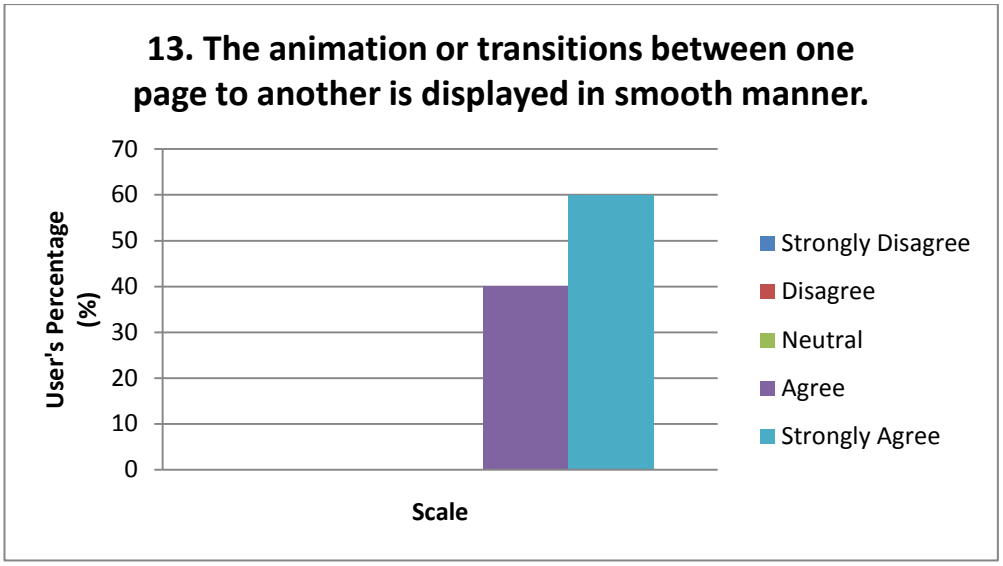


Figure 4.25: Questionnaire 13

The above question focuses on animation where users were asked whether the animations and transitions are displayed in smooth manner. All users agree to that statement where 60% highly agree on that statement and 40% stated agree.

4.4.8 Aesthetic and Minimalist Design

This question is asking the user whether all the information been asked in the app is reasonable to the user.

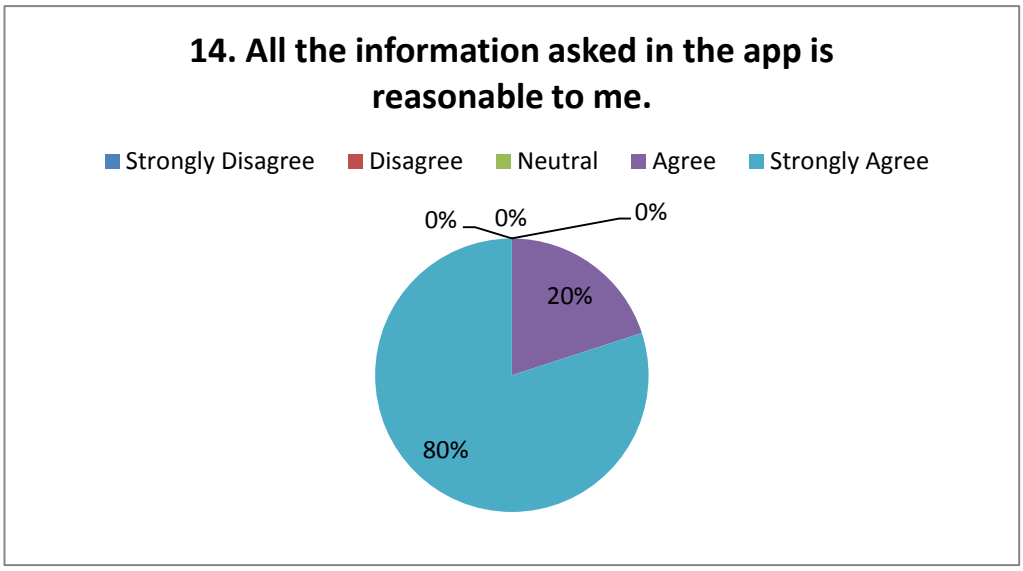


Figure 4.26: Questionnaire 14

Majority of 80% stated Strongly Agree while the remaining 20% selected scale 4 which is Agree. This signifies that all user consent that the information projected in the app is reasonable to user.

4.4.9 Helping Users Recognize, diagnose and Recover from Errors.

The ninth Usability Principle is on the category of Helping Users Recognize, diagnose and Recover from Errors.

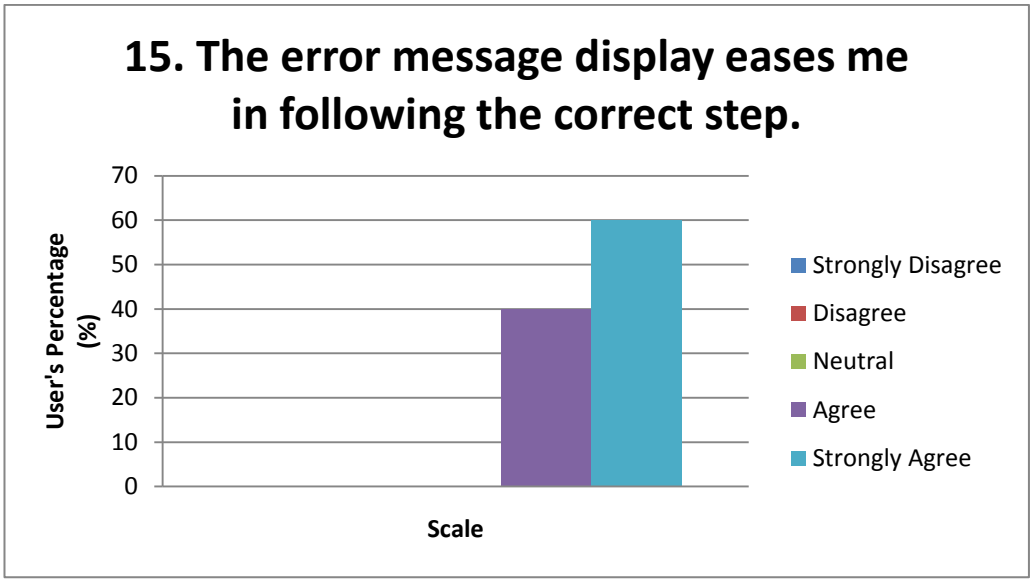


Figure 4.27: Questionnaire 15

The question asked is linked to the fifth usability principle; the Error Prevention, where in this question user are asked whether the error message displayed eases user in following the correct step. This mean that after the user has wrongly entered information or overlook certain text field, the error alert will pop-up. Upon seeing this, user will make a correct step to recover the error. 60% of the user strongly agrees and 40% agrees on the statement.

4.4.10 Help and Documentation

The final principle is on Help and Documentation.

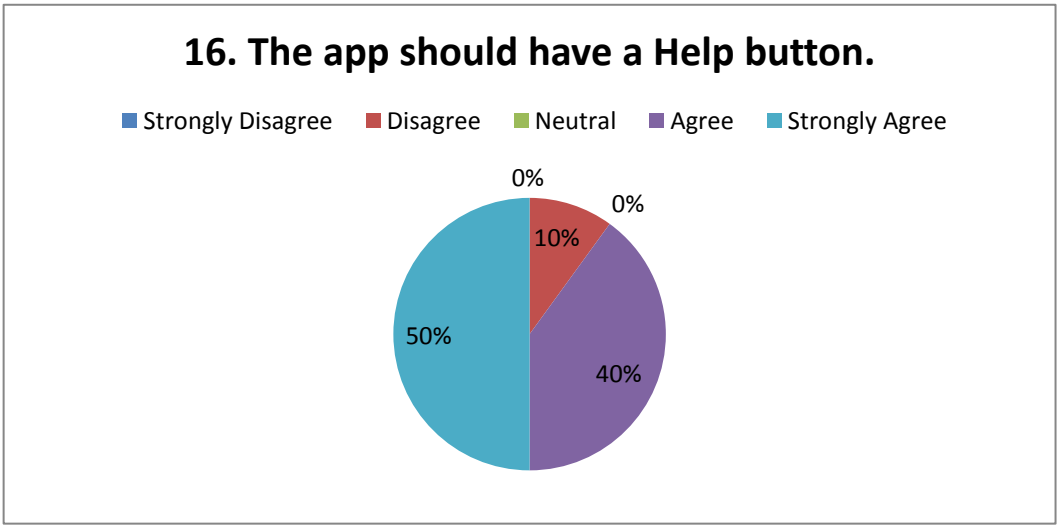


Figure 4.28: Questionnaire 16

In this 16th question, users were asked whether the app should provide a Help button that basically will guide user in filling certain text field or selecting an option. 90% agrees on the needs of having the Help button; 50% strongly agree and 40% agree. Contradicting with the positive selection, 10% of the user selected scale 2 indicating disagrees. The assumption that can be made is that the user might think that the Help button is not necessary and that the users understand the information that needs to be filled.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5. Introduction

This chapter contains two sections, section one will conclude the entire project development processes from the beginning until the end. Sections two will be on the recommendations for the implementation of the project.

5.1 Conclusion

Emergency Accident Alert (EAA) project involves a medical domain in which the information about it needs a lot of detailed research. Through the research, the author had identified problems that may obstruct and delay the lifesaving process. In order to curb the problem, the author had come up with an idea to utilise the technology available in the current trend which is smart phone. Before any application is develop, information is required to be elicited to know the correct flow during the emergency call handled by the Emergency Medical Services. Through findings, a prototype of the application had successfully been built to show the available functionality of the system.

5.2 Recommendations

To further complete the process flow of information, the recommended extension will be:

1. To send the information from operator to the nearest hospital according to the accident scene location.
2. The GPS functions will also display the exact location instead of displaying the latitude and longitude of the accident scene.

3. At the desktop side, there should be a notification of incoming cases to notify the emergency operator of a new case coming in.
4. A location filtration should also be implemented at the operator side to filter the similar location of accident.

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APPENDICES

1. Emergency Accident Alert (Sample User Code)

a. Authentication Page

```
<!---------------------------------- Start of Authenticate page ---------------------------------------------------->

    <div data-role="page" id="authenPage" >
    <div role="main" class="ui-content">
        <h1>User Details</h1>

        <br>

        <h3>Please Enter Your IC or Passport Number</h3>
        <a class="backButton2" style="margin: 0px 0px 0px 250px;" onClick="alertAuthen()">Help</a>

        <div style="margin: 60px;">
            <form>
            <input type="text" id="userdetails" placeholder="xxxxxxxxxxx" size="13">
            </form>

        </div>

        <center>
        <img src="./img/finger.jpg" width='70%' height='50%'/>

        <div data-role="footer" data-position="fixed">
        <center>
            <a href="#" style="color:white;" class="buttonCustom"  onclick="pageOne()">Proceed</a>
            <a style="color:white;" class="buttonCustom2" onclick="exit()">Exit</a>

            <h4 class="footer">EMERGENCY ACCIDENT ALERT</h4 id="footer">
        </div><!-- /footer -->
    </div><!-- /main -->
    </div><!-- /page-->
<!---------------------------------- End of Authenticate page ------------------------------------------------>
```

b. Javascript Code

```
function alertAuthen (){

alert ("The information entered is for security purposes in ensuring the information given by user is not false");

}

function pageOne(){

var userDetails = document.getElementById("userdetails").value;
    if(userDetails != "") {
        window.location.hash = '#page1';
    }
    else {
        alert("Please Enter Your IC or Passport for Security Purposes ");
    }


}
```

2. Emergency Accident Alert (Sample Operator's Code)

```
<body onLoad="exec()">
<center>
<h1>Emergency Accident Alert</h1>
  <center><table id='messagesDiv' border="1px" class='thetab'>
      <tr>
          <th rowspan="2">Date</th>
          <th rowspan="2">Location</th>
          <th rowspan="2">Accident Type</th>
          <th colspan="2"><center>Adult</th>

          <th colspan="2"><center>Children</th>



          <th rowspan="2">Critical</th>
          <th rowspan="2">Moderate</th>
          <th rowspan="2">Minor</th>
          <th rowspan="2">Accident Scene</th>
          <th style="width:200px;" rowspan="2" >Critical Victim 1</th>
          <th style="width:200px;" rowspan="2" >Critical Victim 2</th>
          <th style="width:200px;" rowspan="2" >Critical Victim 3</th>


      </tr>

      <tr>

          <th>Female</th>
          <th>Male</th>
          <th>Female</th>
          <th>Male</th>

      </tr>
  </table>
</center>
</body>
```

3. **Interviewing Sister Ho, Head Nurse of Accident and Emergency Department of Lam Wah Ee Hospital Penang**