1 INTRODUCTION

1.1 Background of Study

The Rapid growth of technology and infrastructure has made our lives easier. The advent of technology and population development, the usage of vehicles are rapidly increasing as human relies on automobile transportation more than all other public transport such as train, bus and airplane. In Malaysia, motor vehicles transportation recorded the highest percentage compared to other transportation method. In year 2014, total motor vehicles transportation is recorded as 24,790,396, which is a very high ratio to the population of Malaysia (Road Transport Department of Ministry of Transportation, 2014).

NEGERI *State*	JUMLAH *Total*
PERLIS	99,726
KEDAH	1,232,002
PULAU PINANG	2,483,837
PERAK	2,129,556
SELANGOR	2,653,004
WILAH PERSEKUTUAN	5,899,338
NEGERI SEMBILAN	898,848
MELAKA	794,983
JOHOR	3,359,148
PAHANG	979,162
TERENGGANU	583,790
KELANTAN	832,027
SABAH	1,149,143
SARAWAK	1,622,063
PORTAL RAKAN NIAGA	73,769
MALAYSIA	24,790,396

Table 1.1: Total Motor Vehicles by State, Malaysia

Furthermore, increasing usage of motor vehicles transportation has also increased the traffic hazards and the road accident that takes place frequently which causes huge loss of life and property. According to International Federation of Red Cross and Red Crescent Societies report (2010), road traffic injuries are a major which are a man-made disaster on the same scale as tuberculosis, malaria and HIV/AIDS but neglected public health challenge that

requires concerted efforts for effective and sustainable prevention, it shows that World widely, an estimated 1.3 million people are killed in road crashes each year and as many as 50 million are injured and it points out that unless there is a new commitment to prevention, the crash death in developing countries should double by 2020. According to World Health Organization 2011, Malaysia is being ranked as 20th in its list of countries with the most death by road accident. Research by the Malaysian Institute of Road Safety (MIROS) showed an average of 18 people killed on Malaysian road daily. However, road safety experts say the real numbers could be higher since many of these accident cases are not even reported. On the other hand, India's road accident records 16% of the world's road accident deaths, whereas India has only 1% of the world's road vehicles (Vijay, Karthikeyan, & Prabhu, 2011). It is due to the increase in the number of vehicles without a subsequent increase in the road facilities required for it.

The current way of reporting the accident is to call police and emergency fire rescue and provide the specific details from the location, extent of injury and the number of people injured. Sometimes people may not know the contacts of the police; rescue team as well as giving the exact location therefore there is loss of life due to delay in the arrival of these authorities which is the ambulance to the hospital in the golden hours. Minimum reduction of the medical response time can be statistically associated with an average decrease of the probability of death by one third, both on motorways and conventional roads (Sanchez-Mangas, Garcia-Ferrrer, de Juan, & Arroyo, 2010). This demonstrates the importance of technologies and its role to accelerate accident emergency response. Thus, this project will provide an optimum solution to this draw back. This project is an intention to implement an innovative solution for this problem by developing an efficient Automatic Accident Location Detection System with an automatic notification to the emergency service with the accident location to save the precious human life. The system can detect accident in significantly less time and sends the basic information to first aid centre within few seconds covering geographical coordinates, the time and angle in which a vehicle accident had occurred. This alert message is sent to the rescue team in a short time, which will help in saving the valuable lives. This system also will provide the facility to

refuse the medical treatment if victim is not badly injured to save the valuable time of medical rescue. Moreover, there will be one more facility provided that in case when a person need medical treatment not for the accident case but for other reason like having a heart attack problem at that time a message is transmitted to the medical help centre by just pressing a single switch.

However in this research therefore investigation on suitable algorithm in calculating the nearest hospital will be studied and a prototype will be developed with the aim of reporting, locating and responding to road accidents in order to reduce the number of life losses. The system is being separated into two parts: vehicle accident detector and website location system. The vehicle accident detector developed by the previous student and meanwhile here the author will continue on the website location system. The vehicle accident detector will scan the X, Y and Z axis of the vehicle for possible car accident and trigger the Global System for Mobile (GSM) to send out the information to the server, while the website location system is to retrieve the geographical coordinates, car plate number, the time and other details from the GSM and GPS machine in the vehicle and process it so that the accident information will be routed to the nearest hospital for rescuing effort. The system will then calculate using the incremental method for getting the nearest hospital from the current GPS coordinate. It will choose the hospital with the lowest distance and send the routing data to the particular hospital system. An alarm will be triggered and the hospital will send their crews for rescuing. The nearest location calculation will be based on the specify radius preferred in kilometer (KM). The hospital can either attend to the alarm or the system will route it to the next nearest hospital for further action. In a nutshell, no one can prevent the accident, but can save their life by expediting the ambulance to the hospital in time.

1.2 Problem Statement

The public authorities have made effort to improve their response capacity to reduce road accidents by placing emergency telephone booth in the highways. However, all this approach is not much helpful in reducing accidents death on the spot because sometimes it takes time for the authorities to reach where the

accident has taken place. This is due to the fact that as there is no such system for locating or identifying where and when accident is taking place and responding to the emergency medical team. The time by which police and emergency medical team approaches to accidental place, by that time usually many lives are lost because the time taken by information to approach rescue teams are more enough. Hence to reduce the economical loss and life loss during vital accidents on roads, it is very important to get information from accident place timely in case of its cause. This research therefore aims at exploiting the existing advanced technologies such as wireless technologies (GPS and GSM) and the possible algorithm to locate the nearby hospital.

1.3 Objectives and Scope of Study

The main objective of this project is:

- To study in finding of best distance algorithm for locating the nearest hospital.
- To study on the existing technologies
- To create a web based front-end interface where reported information can be accessed and displaying the exact location of the accident on the map.
- To test the system for performance and efficiency.

The scope of study is mainly on the motor vehicle road transportation accident only. All the studies on the road transportation, the statistics and all the process flow are being retrieved only if they are related with Malaysia context. The stakeholders that will be involved in this project are the hospital, police, insurance company, fire brigade, and the emergency contact whoever the victim set. Besides that, for this project, the author has used programming fundamental skills learned in the university and during internship in order to complete the project. All the external and internal resources are being used as the references while developing the website and database query.

1.4 Research Questions

The author will have to look at the current way of locating and challenges faced when using such method, based on the following questions;

- What is the current method of locating road accidents?
- How is it possible to report the situation when an accident has happened?
- What is the best algorithm in finding the nearest path between hospital and accidental scene?

1.5 The Relevancy of the Project

This project is relevant to Malaysian car driver as all car drivers are exposed to the same risk of involving in an accident (Goh, 2013).

This project is also important to the hospital as it provide a platform to replace the current method in contacting the emergency medical team which is time and resources consuming. With the assistance of this system, the emergency medical team from any hospital in Malaysia can assist to approach the accidental place on time if accident information arrives on time, in order to reduce the life loss during accidents.

Moreover, this project also can assist the police to identify the path to the accident place by showing the location address to the accident scene. On the other hand, through the information collected from the system, the government can used the information to reduce the economical loss and life loss during vital accidents on roads due to its early response (Kellen, 2013).

Therefore, the objective is relevant to this project as it provides adequate information about the time and the process flow of the current emergency reporting system. Thus, with this information from the study, it will help to improve and modify the current process flow to achieve the best speed to report an accident.

1.6 Feasibility of the Project within Scope & Time Frame

The Automated Accident Location Detection System (AALDS) is a continuation from the previous Final Year Project student. This project is highly recommended by the supervisor as it contributes a lot of value to the society (Goh, 2013). Due to the time constraints, the project has to be scoped to ensure the deliverables can be complete on time.

2 LITERATURE REVIEW

In recent years there has been a movement towards achieving a decrease in road traffic accidents. First, by using the mass media as channels to periodically broadcast traffic campaigns promoting careful driving. Second, there has been a considerable improvement in road conditions. Additional efforts have been made to identify and reduce the number of accident black spot. Third, in the last several years some new rules got into force, for example, the mandatory use of safety belts for all occupants, and the prohibition of using cell phones while driving. Despite various efforts by different agencies against careless driving, accidents are taking place. In most of accident cases, the victims lose their lives because of unavailability of medical facilities at the right time. Moreover, nowadays, nobody in this world is ready to look what's happening around them. Even though, if any accident occurs no one cares about it. An important indicator of survival rates after an accident is the time between the accident and when emergency medical personnel are dispatched to the scene. A study shows that 4.6% of the fatalities in accidents could have been prevented only in Finland if accident information could be divulged at the right time and emergency services could be provided at the place of accident at the proper time (Virtanen, Schirokoff, & Luom, 2005). Eliminating the time an accident occurred and when first responders are dispatched to the scene decreases mortality rate by 6% (White, Thompson, Turner, Dougherty, & Schmidt, 2011). Therefore reporting and responding to the situation by providing the exact location can reduce such danger of losing people's lives due to rate response.

In this literature review, the comparison of distance calculation algorithm is being discussed to find the best distance algorithm to be used for calculating nearest hospital. The accuracy and speed is compared and studied.

2.0 The Earth's True Shape

The Earth is not a perfect sphere and has a slightly distorted shape which is due to its rotation. The rotational momentum tends to force the matter to bunch up in the middle which this "middle" is the equator. Thus the true shape of Earth is called an Oblate Spheroid. According to history, Aristotle and other Greek scholars proposed

that Earth was round as this was based on a number of observation such as the fact that departing ships not only appeared smaller as they sailed but also seemed to sink into the horizon. However, Isaac Newton proposed the otherwise that Earth was not perfectly round. According to (Cook, 2009), “the Earth’s polar diameter is about 43 kilometres shorter than its equatorial diameter, a difference of about 0.3% and this is due to the equatorial bulge caused by the Earth’s rotation”. Oblate spheroid is two orders of magnitude better than the spherical model and the error in approximating the Earth’s shape is less than 100 meters.

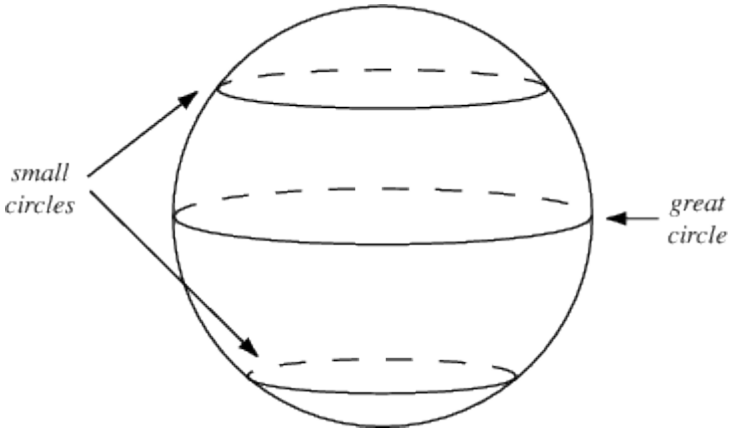
2.1 Distance Calculator Algorithm

In this Literature Review, There are few type of algorithm will be reviewed as listed below:

a) Great Circle Distance (Based on Spherical Trigonometry)

The Great Circle or orthodromic distance is the shortest distance between two points on the surface of a sphere, measured along the surface of the sphere. This algorithm calculates the great circle and assumes that the length of 1’ of arc on the meridian or on the equator equals to 1853.3m which this distance approximates very close to the length of the international nautical mile of 1852m. Thus, the Earth may be treated, without appreciable error, as a sphere where 1’ of latitude is considered equal to 1 nautical mile anywhere on the surface. Besides that, the errors introduced by assuming a spherical Earth based on the international nautical mile are not more than 0.5% for latitude and 0.2% for longitude. In overall, the exact definition of a great circle is the intersection of the surface with a plane passing through the centre of the planet ("Great Circles, Rhumb Lines, and Small Circles,"). According to (Admiralty, 1967), “the great circle is important in navigation because it gives the shortest distance between two points along the surface of a sphere”. (Admiralty, 1967). The formula of Great Circle Distance is:

D = 1.852 * 60 * ARCOS (SIN(L1) * SIN(L2) + COS(L1) * COS(L2) * COS(DG))



b) Spheroidal Model for the Earth

According to Geoscience Australia (2013), "This method assumes a spheroidal model for the Earth with an average radius of 6364.963km. It has been derived for use within Australia. The formula is estimated to have an accuracy of about 200 meters over 50km, but may deteriorate with longer distances." Therefore, this formula is not recommended, as if a hospital is 25km away from the accident location, the accuracy will be as low as 100 meters.

Table 2: Spheroidal model for the Earth calculation

TERM1	=	111.08956 * (DL + 0.000001)
TERM2	=	COS(L1 + (DL/2)
TERM3	=	(DG + 0.000001) / (DL + 0.000001)
D	=	TERM1 / COS(ARCTAN(TERM2 * TERM3))

Source: Geoscience Australia (2013) retrieved from http://www.ga.gov.au/earth-monitoring/geodesy/geodetic-techniques/distance-calculation-algorithms.html

c) Vincenty Formula

Vincenty's fornula is developed by Thaddeus Vincenty in 1975 which are two related iterative methods in grodesy to calculate the distance between two points in the surface of a spheroid. Here, the formula are based on the assumption that the figure of the earth is an oblate spheroid, and hence are more accurate than methods such as Great Circle Distance which assume a

spherical Earth as proven in 2.1 above. Figure below shows the equation of Vincenty Formula.

$$\Delta\sigma = \arctan\left(\frac{\sqrt{(\cos\phi_2 \sin\Delta\lambda)^2 + (\cos\phi_1 \sin\phi_2 - \sin\phi_1 \cos\phi_2 \cos\Delta\lambda)^2}}{\sin\phi_1 \sin\phi_2 + \cos\phi_1 \cos\phi_2 \cos\Delta\lambda}\right).$$

d) Harversine Formula

"Due to the high floating point precision needed in the previous algorithm, Haversine formula is recommended as it does not generate serious rounding errors for distance larger than a few meters" (Goh, 2013). Haversine formula is an equation important in navigation, giving great-circle distances between two points on a sphere from their longitudes and latitudes. According to (Gregory, 2010), "Haversine formula is better for calculation ranging from small distance to great distance". The Harversine Formula is:

6371*2*Atan2(sqrt(1-(SIN((lat2-lat1)/2)^2+COS(lat1)*COS(lat2)*SIN((lon2-lon1)/2)^2)),sqrt(SIN((lat2-lat1)/2)^2+COS(lat1)*COS(lat2)*SIN((lon2-lon1)/2)^2))

e) Modified Harversine Formula (By Eddy Goh)

Modified Harversine Formula was proposed by Eddy Goh as alternative formula to calculate the distance between two points. According to (Goh, 2013), the formula recorded an increase of speed of the execution by 99% and result in 0.0458 seconds of average speed with same accuracy as the original Haversine Formula. The modified Harversine Formula is:

D = 6371 * ACOS(COS(LAT1)*COS(LAT2)*COS(LON2-LON1)+SIN(LAT1)*SIN(LAT2))

f) Spherical Law of Cosines

According to , the simple Spherical Law of Cosines formula gives well conditioned results down to distances as small as a few metres on the earth's surface. This makes this law a reasonable alternative to the harversine formula. Another reason why this law is better than haversine is that Haversine formula uses fewer trigonometry functions but require two square

roots which for computational efficiency, this is will take longer time. The Spherical Law of Cosines is:

D = ACOS(SIN(LAT1)*SIN(LAT2)+COS(LAT1)*COS(LAT2)*COS(LON2-LON1))*6371000

As a conclusion, Vincenty formula is the best distance algorithm. However, the speed taken to calculate the distance using Vincenty formula is slower compared to Haversine Formula. Further accuracy and speed testing on the algorithm will be reported in next chapter.

2.2 PHP vs JAVA

	JSP 	PHP 
EXECUTING SPEED	FAST	SLOW
SECURITY	LOW VULNERABILITY	HIGH VULNERABILITY
LIBRARIES	THERE ARE HUGE AMOUNT OF THIRD PARTY LIBRARIES FOR JAVA WEB DEVELOPMENT OUT THERE	LESS LIBRARIES COMPARE TO JSP
CUSTOM TAGS	ALLOW TO DEFINE CUSTOM TAGS THAT CAN BE QUITE POWERFUL	DOES NOT ALLOW TO DEFINE CUSTOM TAGS
SERVER HOSTING	HOSTING IS NOT MUCH COSTLY THAN PHP	HOSTING IS EXTRAORDINARILY CHEAP

Table 2.2: JSP vs PhP

Currently, the existing website is being developed in PHP. However, looking in future where this system if implemented will be holding millions of car users record and hospital record. Thus, it is important to protect this confidential data from being accessed by unauthorised person. Hence, the usage of JSP will help to solve this issue as PHP has high vulnerability in security compare to JSP. Moreover, in JSP, we are able to define custom tags that can be quite powerful which PHP could not. Not only that, in JSP we are able to access huge amount of third party libraries for Web Development. The executing speed in JSP are also much faster than PHP.

2.3 Related Works

In this technological revulsion world, there is no time for anyone to know what is happening around them as they keep on moving without any care. This is because they giving importance to their work rather than others and the reduce in moral values in them which one cannot get proper help when they need. This however can be solved by technology itself. Many attempts and innovation have taken place before this and it is important to study these attempts which able to find the loopholes in the previous innovations.

Accident Detection in Vehicular Networks through OBD-II Devices and Android-based Smart Phones – In this study, smart phones are used to monitors the vehicle through On-Board-Diagnostic (OBD-II) interface, being able to detect accident and application estimates the vehicle speed and airbag triggers to detect accident. The application then reacts to positive detection by sending details about the accident via SMS and immediately followed by an automatic phone call to the emergency services (Zaldivar, Calafate, Cano, & Manzoni, 2011).

Road Accident Reporting, Locating and Reporting System using GIS and Wireless Technologies – In this study, the accident information will be sent to the traffic control room when an accident occurs on the road network. The controller then informs this information to nearest emergency hospital and police station from mobile phone. Emergency hospitals will use the system to find the accident site on the road network and find the nearest path and allocate an ambulance to the accident site (Kellen, 2013).

WreckWatch: Automatic Traffic Accident Detection and Notification with Smartphone – In this study, the smart phone acts as a mobile sensor, records the path, speed and forces of acceleration on a vehicle leading up to and during an accident without direct interaction with a vehicle's on-board sensors. It will then notify emergency responders of accidents and send pre-coded text and/or audio messages to emergency contacts which are retrieved from contacts. This application also provides an interface that allows third-party observers to contribute accident report data. The WreckWatch client was developed using Google Android (White et al., 2011).

3 METHODOLGY

3.1 Research Methodology

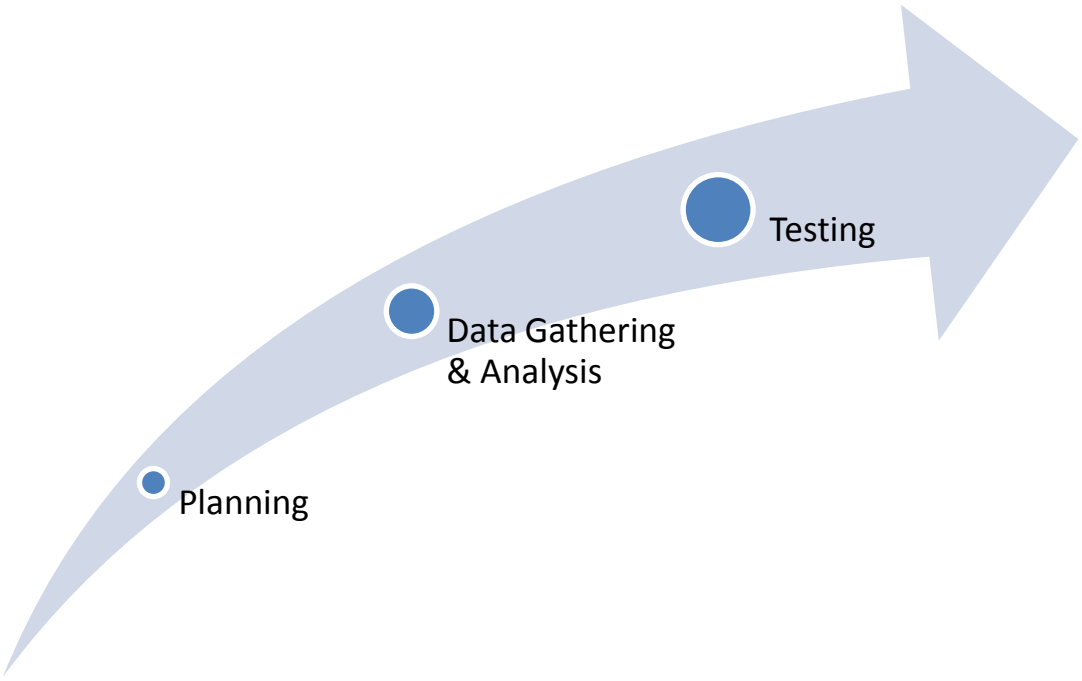


Figure 3.2 Agile Software Research Methodology Model

The preferred research methodology as for this project will be the usage of Rapid Application Development method also known as (RAD). This project will require a lot of trial and errors therefore making throwaway prototyping as the best mean of research methodology for this research. This is due to the nature of this methodology for such a short period of time.

A few qualitative studies were done. Some of the drier and hospital clerk is chosen randomly to get their feedback about the preferred user interface for this system and the system design. The author did a short interview with the road users to get the feedback for the improvement on emergency reporting and rescuing.

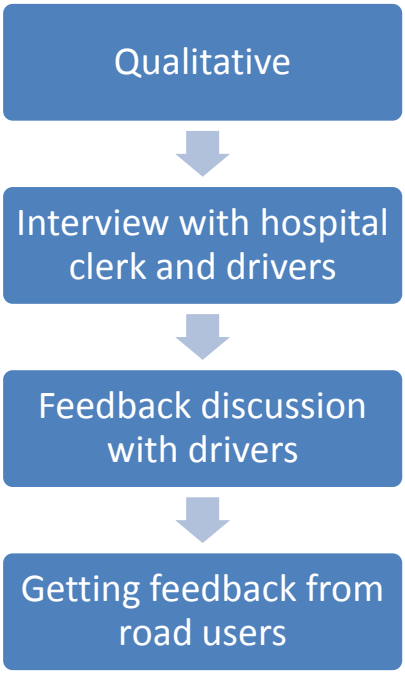


Figure 3.1 Visualization of the Qualitative Research

“The design methodology used to complete the website location system is by using agile software development, a method which rapidly update and change the requirement of the system to fit in with the expectation of the stakeholders, in order to increase the reliability of the system to the user.” (Goh, 2013).

3.2 Design Methodology

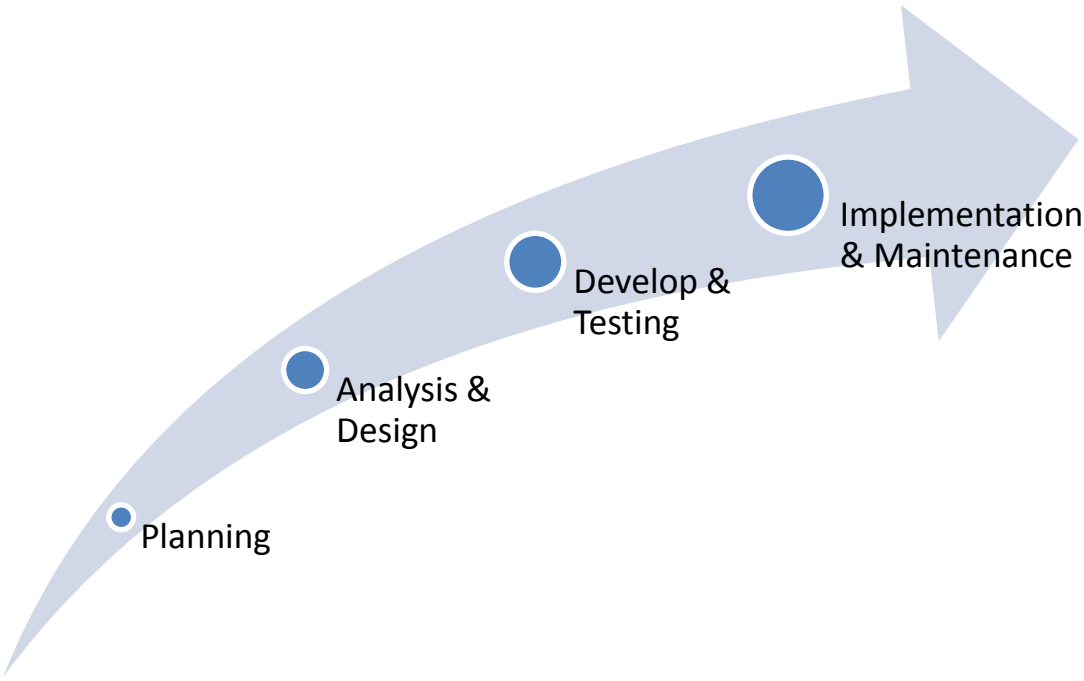


Figure 3.2 Agile Software Development Methodology Model

The project starts with an initial planning of what is the process of the whole project. Then the activity will proceed into the planning and analysis phase where all the tasks will be listed out and arranged into the key milestone and Gantt Chart which will be showed in the later part of this project. Next, the project will continue to the design phase where existing system will be evaluated since this project is the continuation of former FYP project. In here also, the logical system design, database design, and code will be reviewed. Next phase is develop and testing phase. Here, coding of the system, testing and debugging will be carried out. The final output of the coding the real system will be known as the prototype which will be then evaluated and implemented to the current existing server. The whole process is repeated until a complete perfect system is produced.

This method is being used as it gives a maximum flexibility to the user and the development of the project for constantly to be update and allows for future changes of requirement which to meet the expectation by doing continuous

experiment on the system created. Besides that, this system will be built or compiled or integrated on a regular basis and whenever the source code is being updated. This is to check if it is working under the real integrated environment when the code is changed.

3.3 Requirement Analysis and Specification

In this project, the author will be focusing on the suitable algorithm to calculate the nearest part of the hospital to the hospital accident location for immediate emergency report. The system efficiency and performance test will be done by the author once the system is ready for testing. The system also will send a message to the police, fire department and the preferred contact person of the user for notifying them about the accident. "The required functionalities in this system will be the coding for the website to retrieve the information from the short message service (SMS) sent from the device of a car owner and calculate the nearest part to the hospital nearby to redirect them within seconds" (Goh, 2013). To handle the hospital operation for the user to accept or decline the emergency support event, an interface was needed.

3.4 Project Activities

- **Initial Planning**

  A high level view of the project was initiated for this stage of development process. Some readings and research was carried out to get an idea of the project's feasibility. The goals and the objectives of the project have been determined during this phase. These goals will be used as a point of reference for the rest of the development process to ensure that the project stays on track.

- **Planning & Analysis**

  The planning phase were continues by setting up the key milestones and Gantt chart to be followed throughout the project timeline. An interview is done to a few drivers and hospital to collect feedback and explanation on the current situation and the proposed solution.

- **System Design**

  The author has the interface of the website and the whole process flow of the system sketched roughly. The system interface flow is coded in the following phase. The system architecture is finalised as the reference of this project.

- **System Prototyping & Testing**

  Coding is the main activity in this phase. The coding will be based on the process flow, system architecture and the sketches of the design from the previous phase. The system prototyping will start with coding the user interface and testing.

  Alpha Testing – The finished product is tested in the developer's site to check whether it fulfils the requirement specification.

  Beta Testing – The system would be tested in real environment with the real end users.

- **Implementation**

  In this phase, the partial product will be tested in a real system environment with a mock up server and input. Moreover, in this phase debugging is done and all the errors and flaws will be recorded for further planning and prototyping.

- **Maintenance**

  The maintenance phase is usually the longest stage of the software. In this phase the software is updated to:

  - Meet the changing customer requirement needs
  - Adapted to accommodate changes in the external environment
  - Correct errors ad oversights previously undetected in the testing phases
  - Enhancing the efficiency of the software

- **Complete System**

  A complete system will be published if only the prototyping is completed. An incremental software will be released which is used to constantly update the system and fix the bugs and errors.

3.5 Tools Required

The tools required in completing this project are as follows:

3.5.1 Hardware Requirements

- Internet LAN connection
- Platform – based application, which is Windows

3.5.2 Software Requirements

- Eclipse
- JAVA Development Kit 1.7.0_75
    - jdk1.7.0_75\bin\javaw.exe

3.6 Key Milestones

a) FYP 1

Activities/Weeks	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Selection of Project Topic														
Preliminary Research Work														
Submission of Logbook														
Design project outcome														
Project Work continues														
Proposal Defence														

b) FYP 2

Activities/Weeks	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Project Work Continues														
Submission of Progress Report 1														
Poster Pre-Sedex Exhibition														
Submission of Dissertation (Soft bound)														
Viva (Oral Presentation)														
Submission of Dissertation (Hard bound)														

3.7 Gantt Chart

Activities/Weeks	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Initial Planning														
Intro & Background of Study														
Literature Review														
Methodology														
Result & Discussion														
Conclusion														

4 RESULTS & DISCUSSION

4.1 Prototype

The prototype of the system is the website system (interface). Figure below shows the interface design of the web interface.

Figure 4.1 Home page of AALD System

The navigation bar of AALD system consists of:

- About

  Information about his project will be explained in this page. The visitor can have a better understanding on this project and how to use it. The car owner can use this page to update their preferred contact when an accident occurred.

- New Hospital

  This page enables the hospital staff to register their respective hospital information and take part in this system.

- Admin

  An administrator map that shows the pin points of participating hospital and accident location.

- Contacts

  This page shows all the information of the developer and university, just in case any of the visitors is interested to enquire.

- Login

  The login page will provide a login field to select the respective hospital registered in New Hospital page. Then, it will redirect to another page, which will be used by the hospital staff to accept or decline an emergency service request.

- Sign Up

  The sign up page will provide a sign up field to be filled in by car users to register their respective details and car.

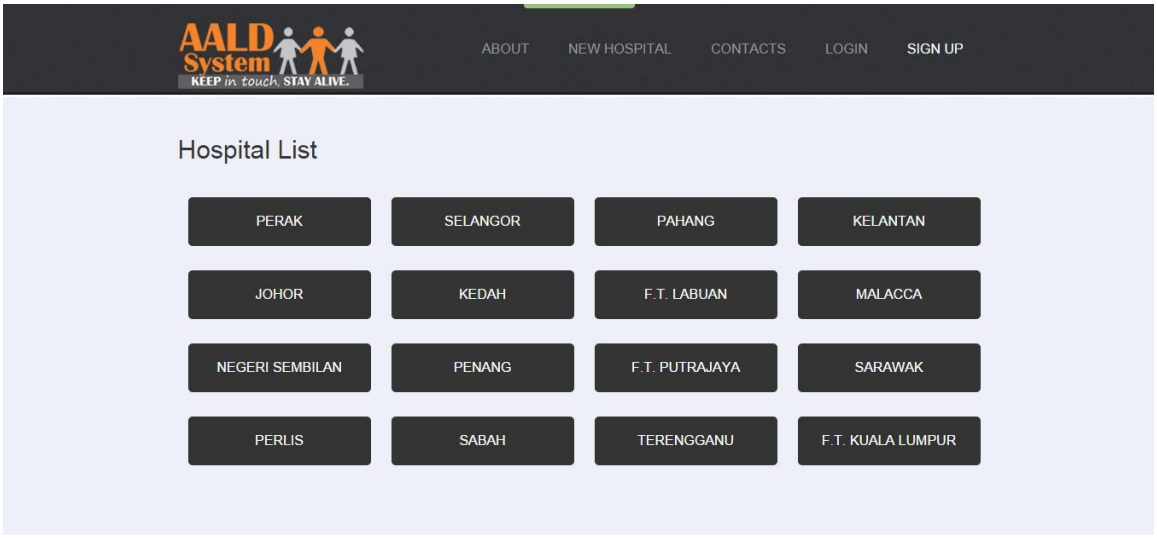


Figure 4.2 Hospital List Page of AALD System

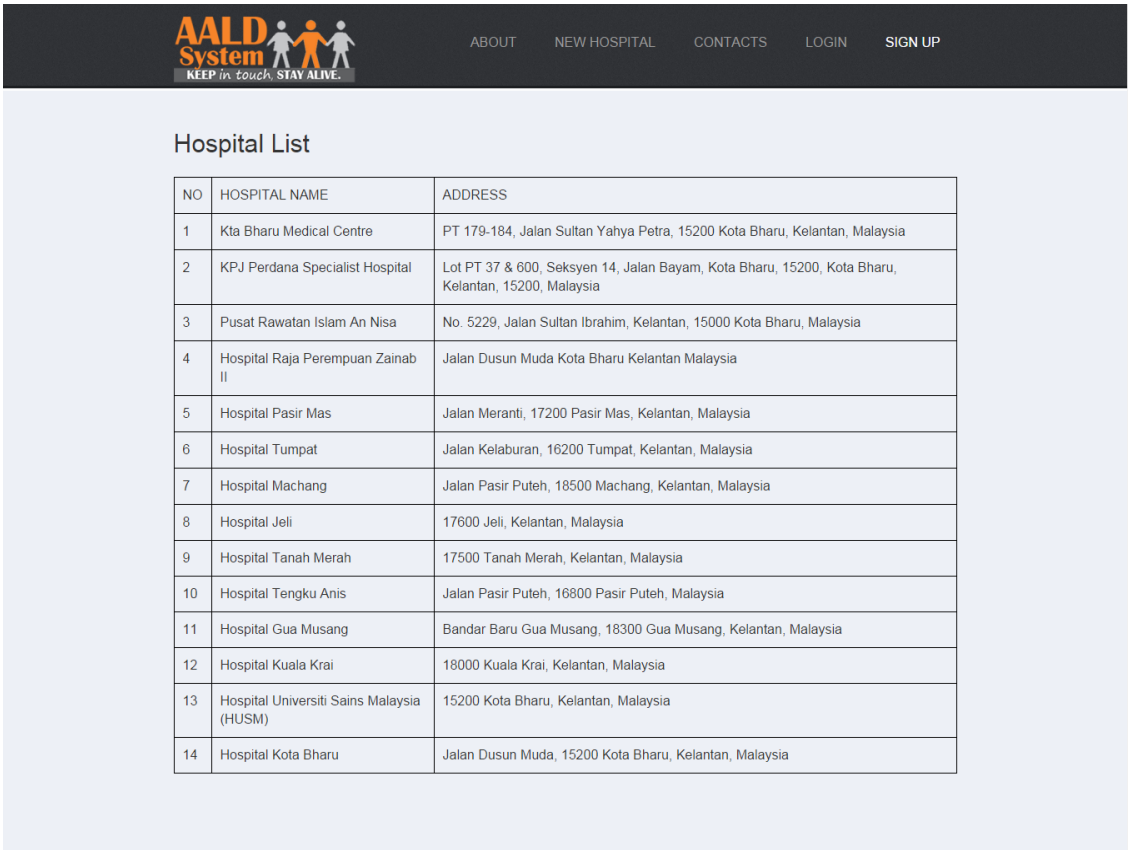


Figure 4.3 Hospital List Page of AALD System

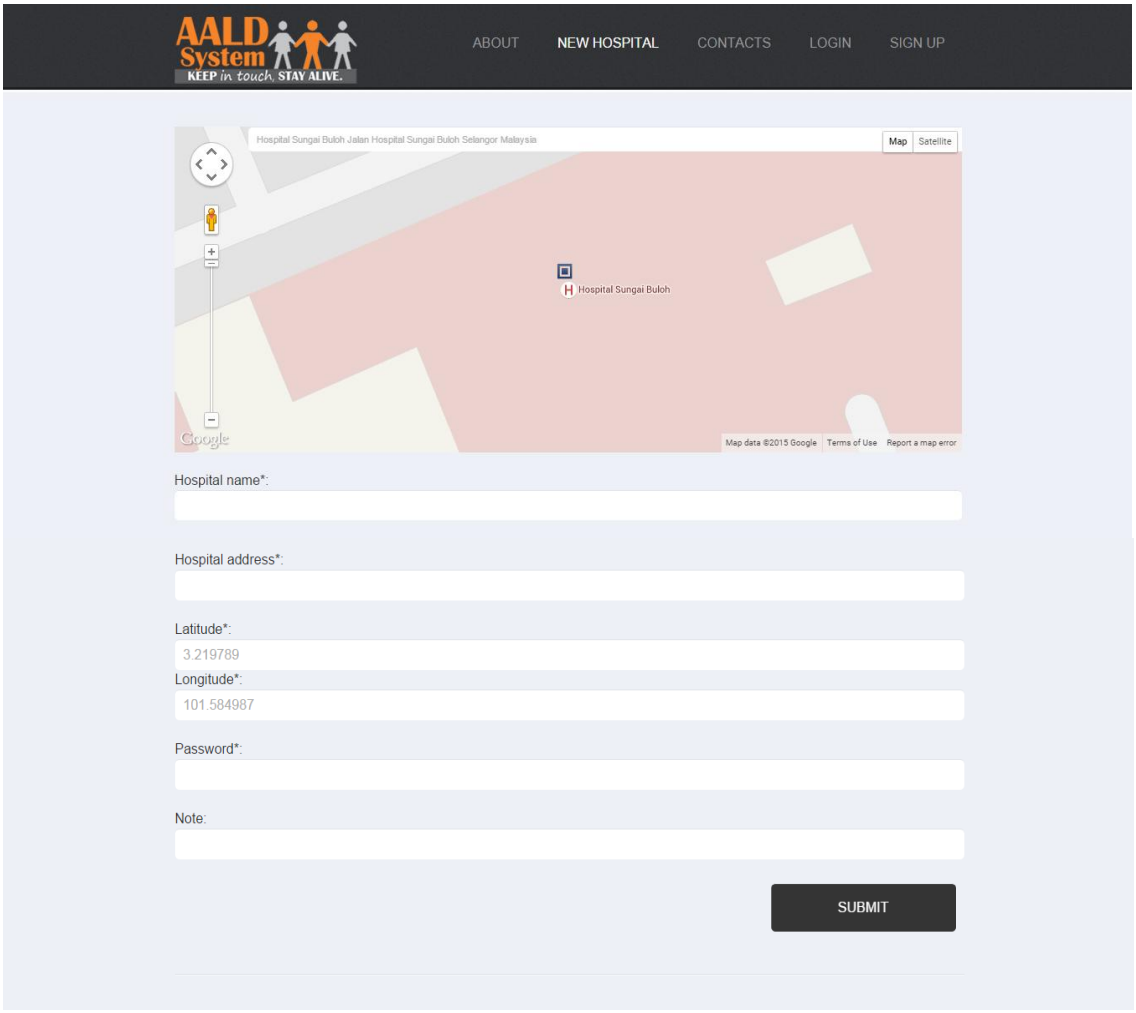


Figure 4.4 Hospital Registration Page of AALD System

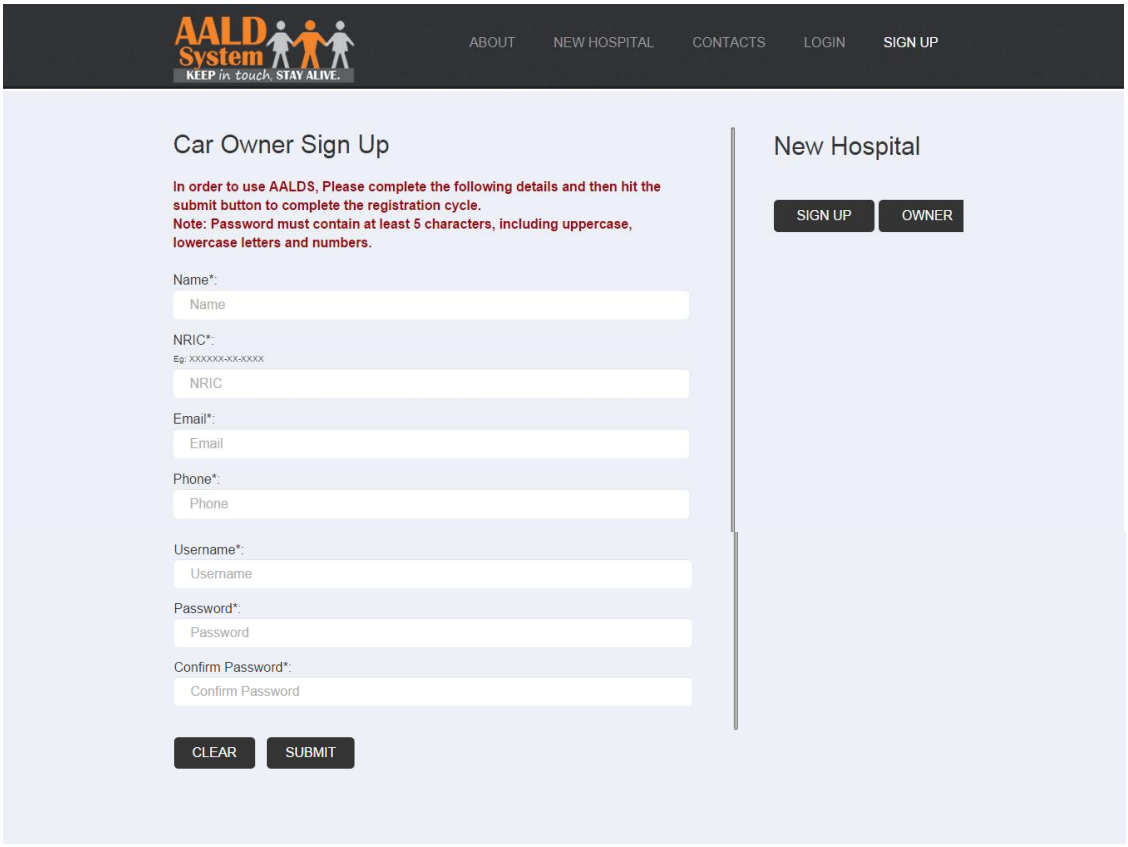


Figure 4.5 Car Owner Registration/Sign Up Page of AALD System

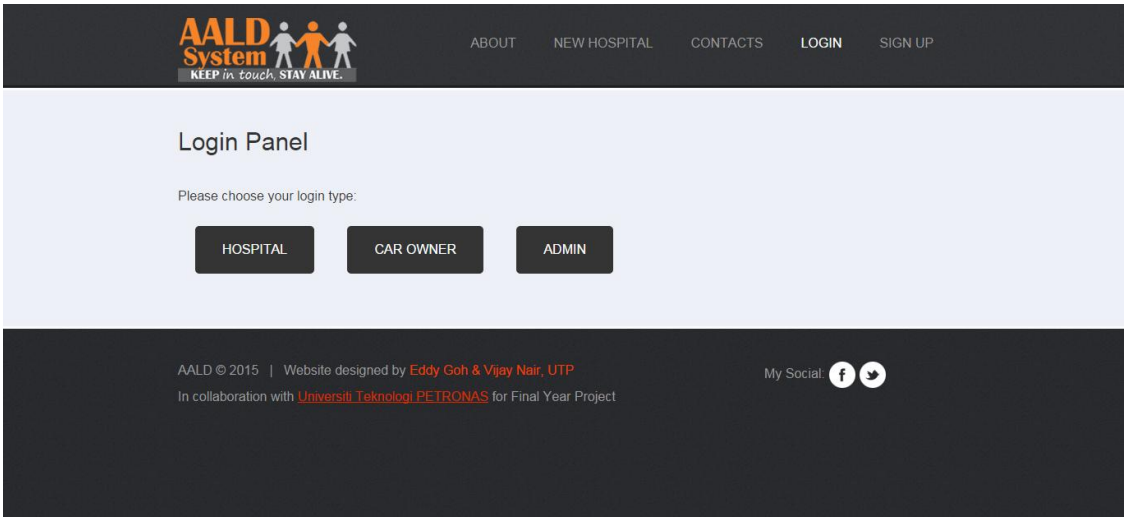


Figure 4.6 Login Page of AALD System

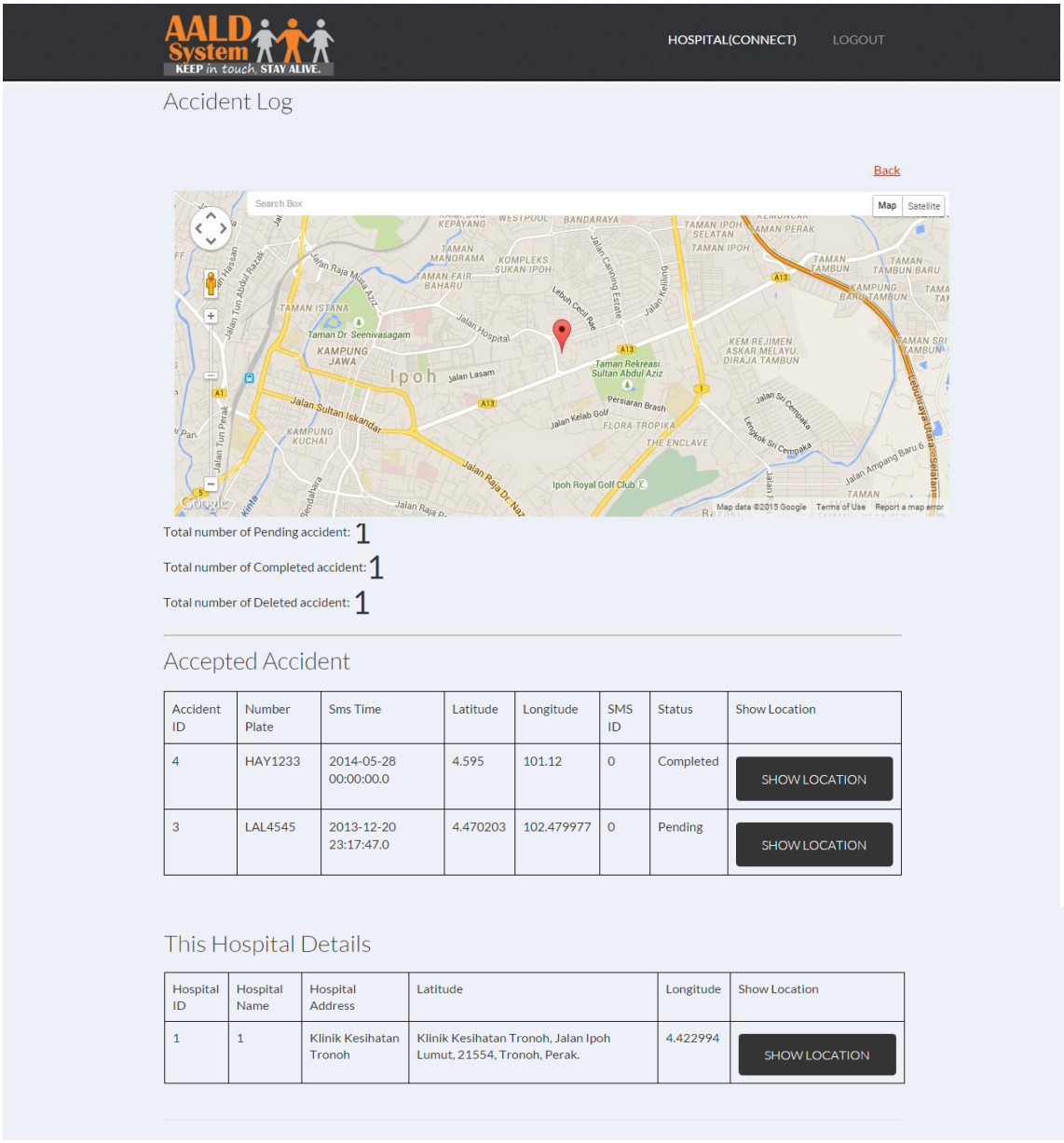
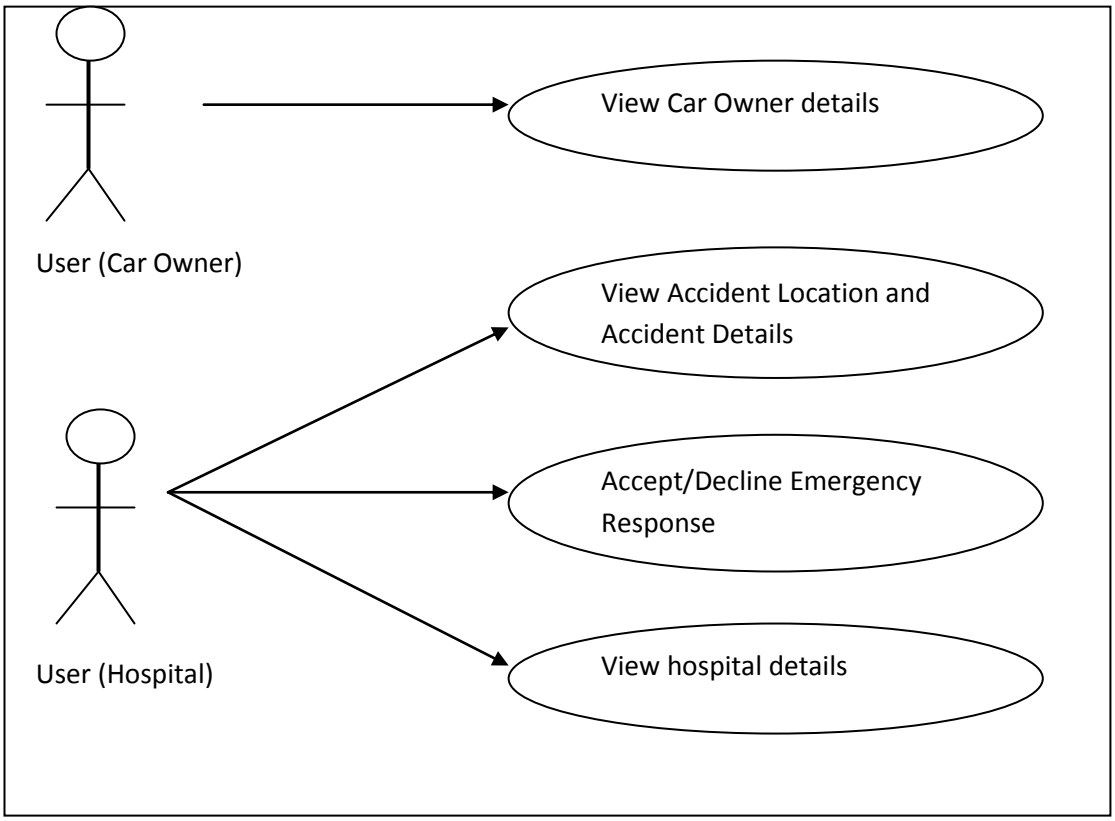


Figure 4.7 Hospital Accident Log Page of AALD System

4.2 Conceptual Diagram of AALDS

4.2.1 Use Case Diagram



4.3 System Design

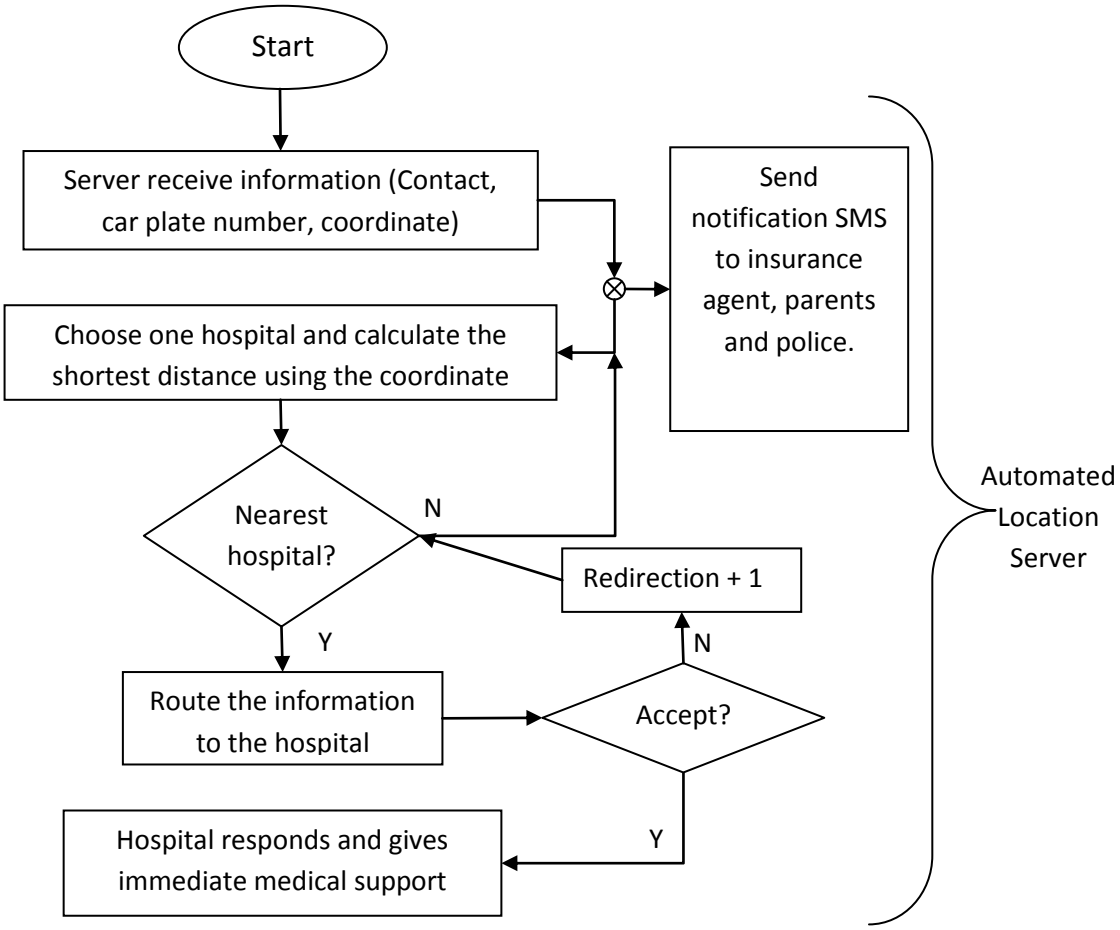


Figure 4.2 Process flow of Automated Accident Location Detection System (Goh, 2013)

The figure above shows the system design process flow chart from the beginning of the event starting from the server side. In the server side, the flow chart starts with receiving of information from the device. The server will redirect the message to the insurance agents, police and parents of the victims as set. On the other hand, the server will calculate the shortest distance of the accident location and the hospital and redirect the message to the particular hospital for rescuing effort.

If the hospital decline or did not respond to the alert within specific time frame, the alert will be redirected to second nearest hospital for rescuing effort. This process will be repeated until there are one hospital has accepted the alert.

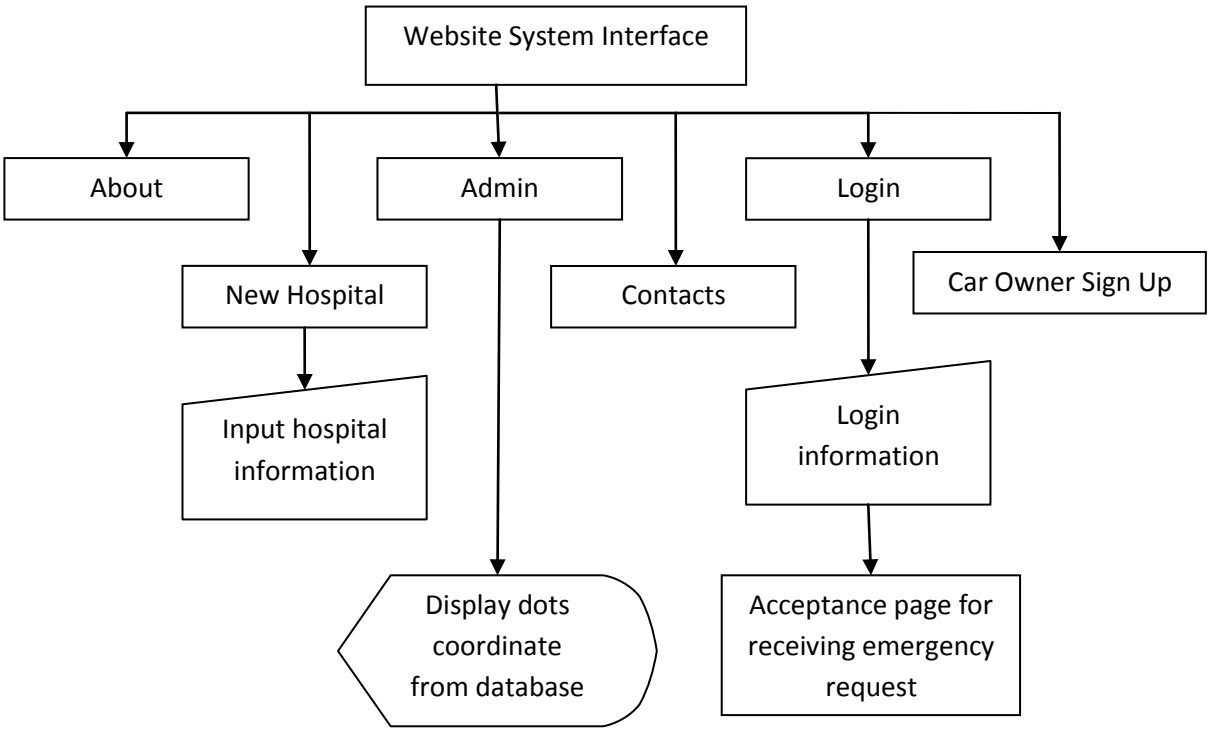


Figure 4.3 Interface chart of Automated Accident Location Detection website system
Figure above shows the website system interface chart.

This explained that the website system interface contains 6 pages and several sub pages.

4.4 Findings and Results of Algorithm Accuracy and Speed

In this project, for the coding, the Harversine Modified Formula will be chosen. The Haversine Modified algorithm performance testing is done using 100 different pair of actual coordinates of hospitals all over Malaysia. The query is executed and used JSP as the interface to get the result. The queries are executed using each of the formula and the result is listed as below. The average time taken for each formula to execute is recorded at the bottom of the table.

Haversine Algorithm

Name	Latitude	Longitude	Distance
Columbia Asia Hospital - Nusajaya	1.478632	103.637269	438.33058019226553
Kluang Utama Specialist Hospital / Pusat Pakar Kluang Utama	2.026547	103.332611	340.3262117630937
KPJ Johor Specialist Hospital	1.475926	103.741054	348.69493410052644
Anson Bay Medical Centre	3.993255	100.996413	444.159419881555

Apollo Medical Centre	4.853724	100.741974	540.4779590097974
Columbia Asia Hospital - Taiping	4.865741	100.734168	541.855065704073
Hospital Fatimah	4.613179	101.112531	513.3371875110253
Kinta Medical Centre	4.588415	101.086908	510.5062539199239
KPJ Ipoh Specialist Hospital	4.594766	101.096095	511.2384634141072
Pantai Hospital Ipoh (Paloh Medical Centre Sdn Bhd)	4.603337	101.119604	512.2671745235912
Pantai Hospital Manjung	4.215830	100.670176	470.1268104764697
Perak Community Specialist Hospital	4.581280	101.099989	509.75067486708724
Sri Manjung Specialist Centre	4.207718	100.675181	469.1871707174873
Taiping Medical Centre	4.847506	100.731793	539.8424297157433
Hospital Raja Permaisuri Bainun	4.603813	101.090795	512.229142223252
Hospital Teluk Intan	4.003644	101.039849	445.3704579148351
Hospital Slim River	3.837452	101.404313	429.49451563493295
Hospital Changkat Melintang	4.313212	100.910799	479.7945102621117
Hospital Kuala Kangsar	4.772829	100.931452	530.8855485679436
Hospital Gerik	5.429056	101.127767	604.0948695592812
Hospital Kampar	4.311777	101.156476	480.01075250607414
Hospital Parit Buntar	5.131555	100.483529	573.360336919324
Hospital Selama	5.213107	100.688946	580.6997841874372
Hospital Seri Manjung	4.185418	100.661980	466.8198447178959
Hospital Sungai Siput	4.827984	101.057065	537.0779203799519
Hospital Tapah	4.602653	101.065394	512.0365360112341
Hospital Taiping	4.850999	100.736910	540.2024197557407
Ara Damansara Medical Centre	3.114869	101.565427	352.63527856339397
Arunamari Specialist Medical Centre	3.015169	101.433922	339.238532982659
Assunta Hospital	3.093415	101.645344	352.0664905846682
Beacon International Specialist Centre	3.091418	101.637997	351.6771281033489
Columbia Asia Extended Care Hospital	3.047220	101.504644	344.02334194741513
Columbia Asia Hospital - Bukit Rimau	2.997342	101.529121	339.04380544645534
Columbia Asia Hospital - Puchong	3.024123	101.622205	343.99074291302816
Demc Specialist Hospital	3.071707	101.524128	347.0818633840195
Hospital pakar An-Nur Hasanah	2.960132	101.753714	340.4597332323698
Hospital Pusrawi SMC Sdn Bhd	2.992200	101.791320	344.98732196490147
Hospital Sungai Long Sdn Bhd	3.039875	101.795046	350.2130376538944
Kelana Jaya Medical Centre	3.108667	101.595471	352.5966159218786
Klinik Pakar Wanita Sheela dan Rumah Bersalin	3.049448	101.472577	343.6747504325388
KPJ Ampang Puteri Specialist Hospital	3.159941	101.751946	361.94759146252136
KPJ Damansara Specialist Hospital	3.079546	101.592652	349.35923198888895
Time (Seconds)		8	

Vincenty Algorithm

Name	Latitude	Longitude	Distance

Columbia Asia Hospital - Nusajaya	1.478632	103.637269	338.52113585698123
Kluang Utama Specialist Hospital / Pusat Pakar Kluang Utama	2.026547	103.332611	345.1256161456444
KPJ Johor Specialist Hospital	1.475926	103.741054	348.5409919034417
Anson Bay Medical Centre	3.993255	100.996413	441.56536959553034
Apollo Medical Centre	4.853724	100.741974	537.3305874121871
Columbia Asia Hospital - Taiping	4.865741	100.734168	538.7002153203472
Hospital Fatimah	4.613179	101.112531	510.3418842691266
Kinta Medical Centre	4.588415	101.086908	507.5263422232559
KPJ Ipoh Specialist Hospital	4.594766	101.096095	508.254651045341
Pantai Hospital Ipoh (Paloh Medical Centre Sdn Bhd)	4.603337	101.119604	509.2784051468976
Pantai Hospital Manjung	4.215830	100.670176	467.39543426815186
Perak Community Specialist Hospital	4.581280	101.099989	506.7756528951548
Sri Manjung Specialist Centre	4.207718	100.675181	466.46075362336285
Taiping Medical Centre	4.847506	100.731793	536.6994415823561
Hospital Raja Permaisuri Bainun	4.603813	101.090795	509.23937719790393
Hospital Teluk Intan	4.003644	101.039849	442.7674960779488
Hospital Slim River	3.837452	101.404313	427.01871628550236
Hospital Changkat Melintang	4.313212	100.910799	476.99143663426105
Hospital Kuala Kangsar	4.772829	100.931452	527.7857476657714
Hospital Gerik	5.429056	101.127767	600.574595175462
Hospital Kampar	4.311777	101.156476	477.2114505764313
Hospital Parit Buntar	5.131555	100.483529	570.0490144763351
Hospital Selama	5.213107	100.688946	577.3229792494731
Hospital Seri Manjung	4.185418	100.661980	464.1086883373264
Hospital Sungai Siput	4.827984	101.057065	533.9430204941877
Hospital Tapah	4.602653	101.065394	509.04703764217544
Hospital Taiping	4.850999	100.736910	537.0569660853777
Ara Damansara Medical Centre	3.114869	101.565427	350.6536827900026
Arunamari Specialist Medical Centre	3.015169	101.433922	337.3045796578399
Assunta Hospital	3.093415	101.645344	350.1120906617133
Beacon International Specialist Centre	3.091418	101.637997	349.72280618515293
Columbia Asia Extended Care Hospital	3.047220	101.504644	342.07762244677
Columbia Asia Hospital - Bukit Rimau	2.997342	101.529121	337.13463289027686
Columbia Asia Hospital - Puchong	3.024123	101.622205	342.07859876694647
Demc Specialist Hospital	3.071707	101.524128	345.12272786813725
Hospital pakar An-Nur Hasanah	2.960132	101.753714	338.61494443852996
Hospital Pusrawi SMC Sdn Bhd	2.992200	101.791320	343.1285901176119
Hospital Sungai Long Sdn Bhd	3.039875	101.795046	348.322860257569
Kelana Jaya Medical Centre	3.108667	101.595471	350.62381583959416
Klinik Pakar Wanita Sheela dan Rumah Bersalin	3.049448	101.472577	341.7231774126871
KPJ Ampang Puteri Specialist Hospital	3.159941	101.751946	359.968011698164
KPJ Damansara Specialist Hospital	3.079546	101.592652	347.40533058033236

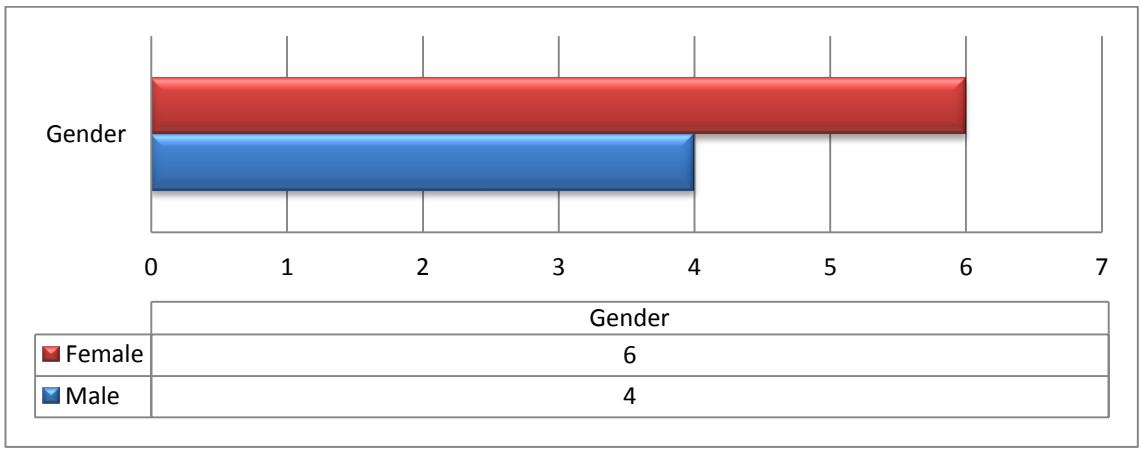
Time (Seconds)	15

Modified Harversine Algorithm

Name	Latitude	Longitude	Distance
Columbia Asia Hospital - Nusajaya	1.478632	103.637269	438.20677353830445
Kluang Utama Specialist Hospital / Pusat Pakar Kluang Utama	2.026547	103.332611	370.7275124116471
KPJ Johor Specialist Hospital	1.475926	103.741054	446.2826271087241
Anson Bay Medical Centre	3.993255	100.996413	43.853961003929435
Apollo Medical Centre	4.853724	100.741974	57.926858954497305
Columbia Asia Hospital - Taiping	4.865741	100.734168	59.50852597984462
Hospital Fatimah	4.613179	101.112531	29.454638498548853
Kinta Medical Centre	4.588415	101.086908	25.64412627164574
KPJ Ipoh Specialist Hospital	4.594766	101.096095	26.762569213911828
Pantai Hospital Ipoh (Paloh Medical Centre Sdn Bhd)	4.603337	101.119604	28.95507863602875
Pantai Hospital Manjung	4.215830	100.670176	38.713041892432685
Perak Community Specialist Hospital	4.581280	101.099989	25.711067383090615
Sri Manjung Specialist Centre	4.207718	100.675181	38.687956049285106
Taiping Medical Centre	4.847506	100.731793	57.823880339058306
Hospital Raja Permaisuri Bainun	4.603813	101.090795	27.353030244151725
Hospital Teluk Intan	4.003644	101.039849	43.246809311787885
Hospital Slim River	3.837452	101.404313	77.52417948476389
Hospital Changkat Melintang	4.313212	100.910799	10.80547641340564
Hospital Kuala Kangsar	4.772829	100.931452	43.16077136197254
Hospital Gerik	5.429056	101.127767	117.11159280469325
Hospital Kampar	4.311777	101.156476	21.874010374581097
Hospital Parit Buntar	5.131555	100.483529	99.04602078541143
Hospital Selama	5.213107	100.688946	97.1422355351255
Hospital Seri Manjung	4.185418	100.661980	41.24344142653173
Hospital Sungai Siput	4.827984	101.057065	49.8858700266386
Hospital Tapah	4.602653	101.065394	26.021584747658398
Hospital Taiping	4.850999	100.736910	57.908309000198116
Ara Damansara Medical Centre	3.114869	101.565427	155.92750342339863
Arunamari Specialist Medical Centre	3.015169	101.433922	160.8462950945685
Assunta Hospital	3.093415	101.645344	161.97566150216946
Beacon International Specialist Centre	3.091418	101.637997	161.80021937812938
Columbia Asia Extended Care Hospital	3.047220	101.504644	160.1843018866547
Columbia Asia Hospital - Bukit Rimau	2.997342	101.529121	166.34177156376666
Columbia Asia Hospital - Puchong	3.024123	101.622205	167.73986349392734
Demc Specialist Hospital	3.071707	101.524128	158.47461792230737
Hospital pakar An-Nur Hasanah	2.960132	101.753714	180.7092946041394
Hospital Pusrawi SMC Sdn Bhd	2.992200	101.791320	179.65544801257744
Hospital Sungai Long Sdn Bhd	3.039875	101.795046	175.3125885234389
Kelana Jaya Medical Centre	3.108667	101.595471	157.97933376573326

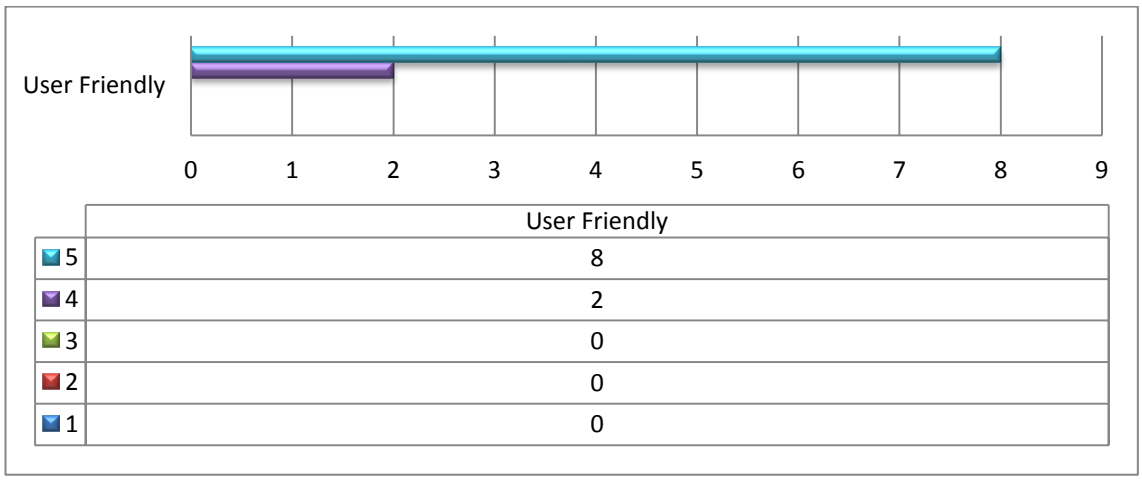
Klinik Pakar Wanita Sheela dan Rumah Bersalin	3.049448	101.472577	158.67911424297907
KPJ Ampang Puteri Specialist Hospital	3.159941	101.751946	161.44265877042986
KPJ Damansara Specialist Hospital	3.079546	101.592652	160.76581845788914
Time (Seconds)		6	

Results of the testing interview (Beta Testing)

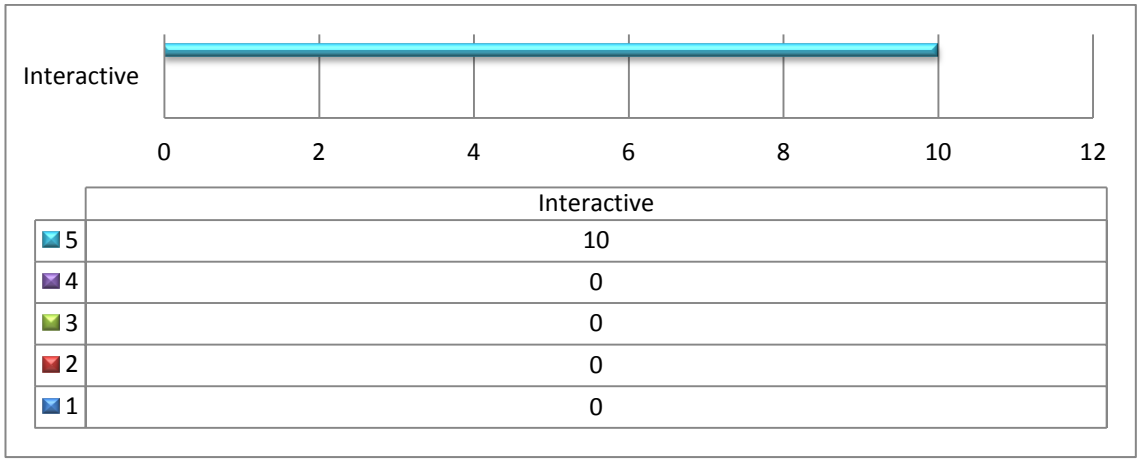


The respondents to the survey were consisting of 2 male respondents and 2 female respondents.

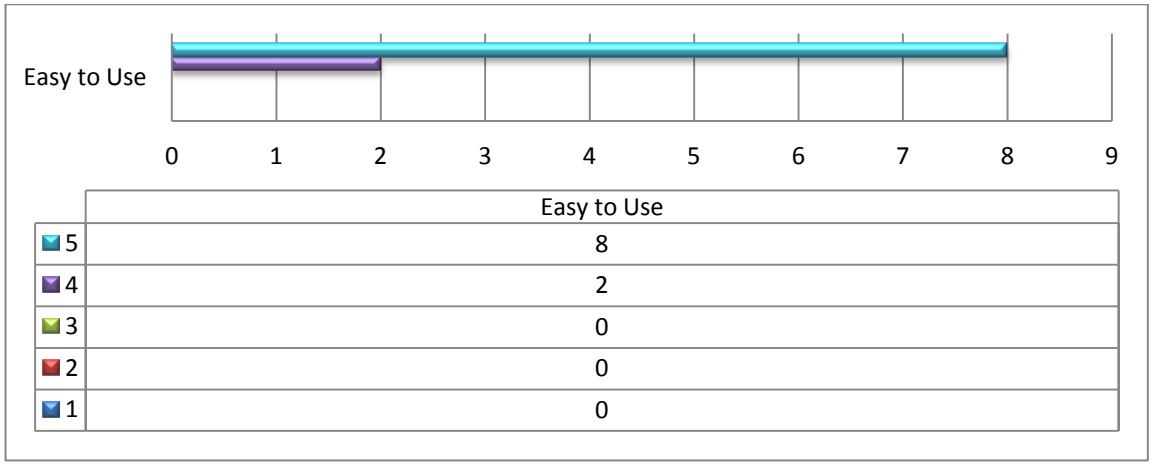
Strongly Agree = 5
Strongly Disagree = 1



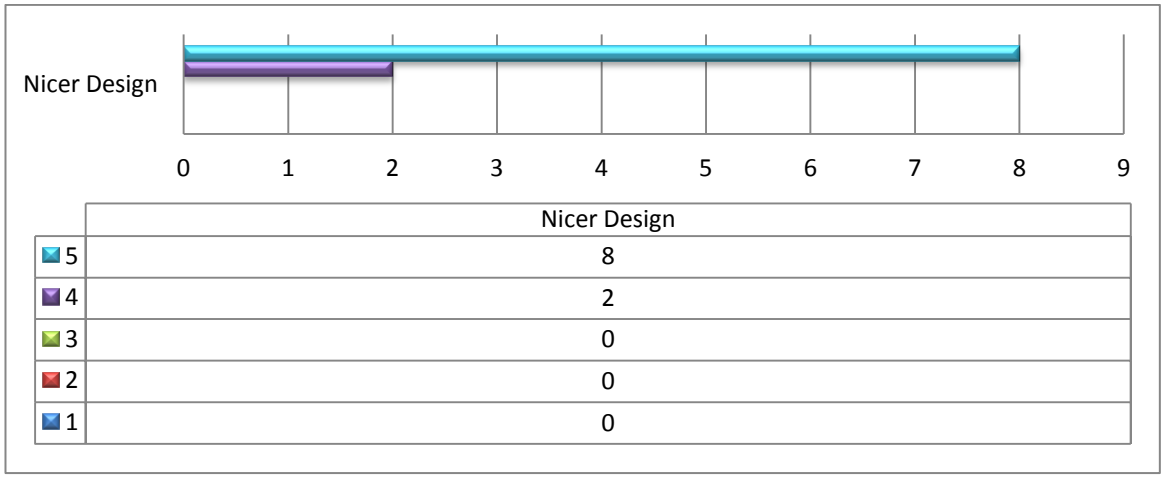
Out of 10 respondents, 8 respondents strongly agree with the web design being user-friendly and 2 respondents agree with it.



All 10 respondents strongly agreed that the web design created by the author is interactive.

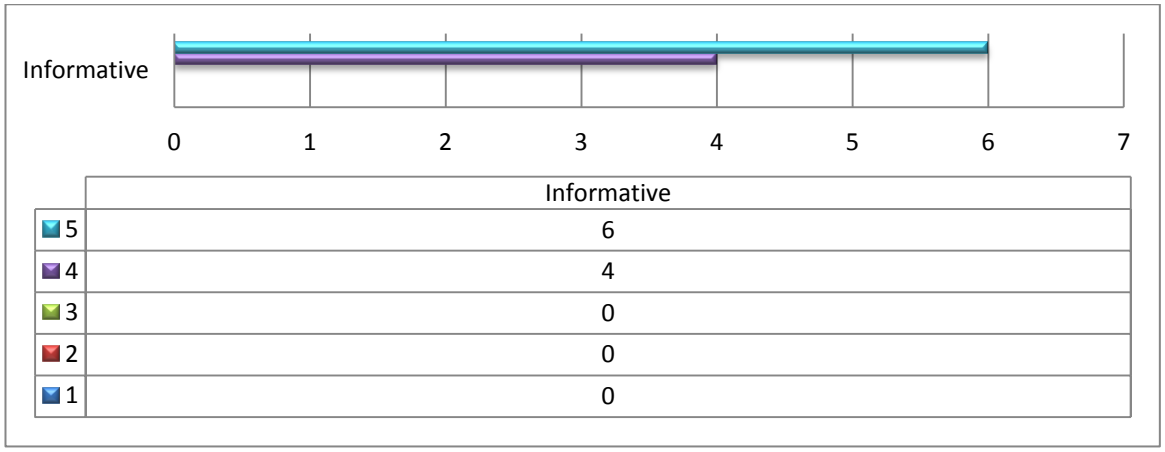


Out of 10 respondents, 8 respondents strongly agree with the web design being easy to use and 2 respondents agree with it.



	Nicer Design
5	8
4	2
3	0
2	0
1	0

Out of 10 respondents, 8 respondents strongly agree with the web design is a nicer design look and 2 respondents agree with it.



	Informative
5	6
4	4
3	0
2	0
1	0

Out of 10 respondents, 6 respondents strongly agree with the web design is informative enough and 4 respondents agree with it.

5 CONCLUSION & RECOMMENDATION

5.1 Conclusion

With this technology, the authority will be able to provide a better and faster service to the public in term of instant medical attention. Since there are no verbal communications in this system, there are zero communication gaps in reporting any accidents. This system will be able to provide instant medical attention and reduce the fatal rate of accident in Malaysia. Therefore by implementing this system, the system would be able to replace the current emergency operator and provide the most efficient and faster service to the users.

5.2 Recommendation

For future works, the suggestion will be including the manual system to allow the passenger or the driver to cancel the notification to the nearby hospital if false alarm of accident happens. Another feature to allow the driver to manually notify the hospital should be in place in the case or emergency happens in the middle of the journey. Security features should be implemented in the system to avoid hackers to send or retrieve anonymous data from the server. The security features such as CAPTCHA, SQL injection, cross-site scripting and URL encryption should be taken care of before the products are being published to be used in the real world.

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