Better Emergency Logistics

Project report

submitted in fulfillment of the requirements for the Degree of

BACHELOR OF TECHNOLOGY

By

PRINCE CHAUHAN (141235)

AAYUSH BANIYAL (141239)

Under the supervision of

Dr. Suman Saha

Department of Computer Science & Engineering

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

May, 2018

Candidate's Declaration

I hereby declare that the work presented in this report entitled **"Better Emergency Logistics"** in partial fulfillment of the requirements for the award of the degree of **Bachelor of Technology** in **Computer Science and Engineering** submitted in the department of Computer Science & Engineering and Information Technology**,** Jaypee University of Information Technology Waknaghat is an authentic record of my own work carried out over a period from August 2017 to May 2018 under the supervision of **Dr. Suman Saha.**

The matter embodied in the report has not been submitted for the award of any other degree or diploma.

Prince Chauhan (141235)

Aayush Baniyal (141239)

This is to certify that the above statement made by the candidate is true to the best of my knowledge.

(Supervisor Signature)

Dr. Suman Saha
Assistant Professor
Dept. of Computer Science
Jaypee University of Information Technology,
Solan, Himachal Pradesh.

ACKNOWLEDGEMENT

The completion of any challenge relies upon the cooperation, co-ordination and combined efforts of numerous resources of knowledge. We are grateful to our guide Dr. Suman Saha for his even willingness to offer us valuable insight and path. We're immensely thankful to him for providing guidance for this mission.

We also are thankful to Dr. Satya Prakash Ghrera, FBCS, SMIEE Professor, Brig(Retd.)& Head, department of CSE and IT) and all the staff contributors for his or her colossal cooperation and motivation for completing out our venture.

Thanking you,

Prince Chauhan (141235)

Aayush Baniyal (141239)

TABLE OF CONTENT

LIST OF FIGURES

ABSTRACT

Nowadays, the unparalleled growth in avenue traffic congestion has led to severe consequences on individuals, financial system and surroundings, especially in city areas in most of the big cities worldwide. The most critical amongst the above consequences is the postpone of emergency motors, such as ambulances and police automobiles, leading to accelerated deaths on roads and huge financial losses. To relieve the impact of this hassle, we intend to design an advanced adaptive algorithm based software where permits the user to access better emergency logistics and at the same time keeping a minimal increase in congestion level across the direction of the emergency car. This could be accomplished with a visitor's management gadget to be able to implementing modifications to the road community's control and riding guidelines following the suitable and properly-tuned adaptation strategy.

This latter is determined primarily based on the severity of the emergency scenario and current traffic conditions expected using a fuzzy logic based totally scheme. The obtained simulation outcomes, the usage of a hard and fast of ordinary street networks, have validated the effectiveness of our method in phrases of the significant discount of emergency automobiles' reaction time and the negligible disruption prompted to the non-emergency motors touring on the identical street community.

CHAPTER -1 INTRODUCTION

1.1 Introduction

Street congestion is amongst the most challenging problems that modern avenue visitors government are facing because of overwhelming outcomes that come at the side of it. Amongst them impacts, the delay of ES (emergency services) is the crucial because of an incurred loss in phrases of accidents, financial losses and deaths. India bills for about 10% of avenue crash fatalities worldwide. In phrases of absolute numbers, greater people die in avenue crashes in India than anywhere else inside the world. Most of the accidents that cause death are because of ambulance's overdue reaction.

Currently, the ambulance carrier have an obligation to arrive on the venue of impact of half of the emergency calls inside 7 minutes and 14 mins for the 90% of them. The authorities are working towards lowering this goal to 90% within 8 minutes. Some other manner to lessen delays could be for the various "first responders", such as fireplace-fighters, the police, community volunteers, to be readily equipped with “smart defibrillators" within a medically controlled device. Health service for instance has extra stations in comparison to the ambulance carrier to permit it to satisfy it's more diversified targets . 90% of these vehicles are expected to be at the scene of a fire inside five mins of the emergency call as the first responders.

That being stated early get entry to hospital treatment is a crucial factor in ensuring positive patient outcomes in emergency situations. This has been strengthened by way of Chain of Survival concept in out-of-health center cardiac arrests, wherein enormous upgrades in survival costs had been finished by using early get entry to medical care and defibrillation, which reflects the significance of minimizing the put off to first on scene clinical intervention.

The healthcare industry has substantially evolved both technologically and scientifically over the final century. sicknesses that killed thousands and thousands of people within the previous century may additionally now be useless and gone. but, population sturdiness, street accidents, the range of sedentary human beings, and the occurrence of growing older diseases have all increased. therefore, the demand for EMS in massive towns is growing on the identical charge. as a result, healthcare regulations have to be updated to keep up with those

adjustments. In developing countries inclusive of India, the effect of those adjustments appear stronger, and new rules must be carried out as soon as feasible.

In spite of all the advancement in technology and emergency response training and management (ERT), people and government agencies all over the world are still struggling to contain and minimize the humongous loss of lives and property. Ironically the tools and technologies to prevent or minimize the loss are to a large extent already available however, what is missing is a standard, central, and uniform approach to implement and manage.

In emergency medicinal drug, the golden hour is a term that refers to the which lasts for around one hour or less, following worrying damage being inflicted via a casualty emergency. In this time there may be a very high possibility that the spark off clinical treatment will save you from demise. It's far properly hooked up that the affected person's possibilities of survival are finest in the event that they acquire care inside a quick time period after a extreme harm. However since there is nil proof to indicate whether survival rate steadily drop down after 60 mins. A bunch of people are blatantly having come to apply this term to relate to the prime attributes of the speedy intervention in these trauma cases, rather than this slender viewpoint which means of an essential one-hour term.

Most of the available solutions may match properly for excessive density regions, however, with a boom within the place to be blanketed(like rural regions in our country), there's sizable quantity of time taken with the aid of the first respondents. subsequently, there may be a requirement of an optimized answer, that is adaptive with appreciate to the topological changes, among others because of the high speed of the vehicles and generated indicators at steady intervals.

Preserving in view the aforementioned challenges and drawbacks inside the existing works, we advise a collaborative routing strategy together with resource gathering beforehand of time if you want to result in assist to the community of humans to use the rescue operations.

Within the proposed approach, this system considers the environment and the parameters along with car density and distance from street aspect devices (RSUs). Treating those parameters as entering variables, the program produces an output for the direction to betaken.

Moreover, the software program will inform the sanatorium about to get hold of the patient to ready all of the vital equipment and medical doctors ahead.

The values of these parameters are exceeded on for all of the to be had options. the choice of a path depends upon the output produced via taking into the attention the automobile density, and distance from the destination in that place, physician and system availability giving output as the opportunity of survival.

1.2 PROBLEM STATEMENT

Due to delayed response of emergency services during times of dire need might result in loss of property, money and most importantly life.Several thousands of people are at a loss of life due to the fact ambulances take too long to reply emergency calls, it was revealed the day before today.

Best three of Britain's 32 ambulance services attain a massive majority of 'straight away lifestyles-threatening' name-outs inside eight mins, in line with the state-of-the-art facts.

All of the rest are falling quickly of government objectives - laid down three years in the past - that 75% of pressing calls are reached in that time.

Specialists say that 3,000 more heart attack sufferers can be saved every yr if 90% of 999 calls had been spoken back in that time. The case is just not limited to place such as England. It is perhaps much worse in a developing country like India where the delay is much worse and the resources far less adequate

Whilst there are a number of uncertainties as to the data, it seems that there is a difference around the country in how patients are being treated and their outcome.Ofcourse your geographical location comes in huge as to whether you will get the proper medical attention well within the golden hour time frame.

These Emergency Response Deficiencies are mainly contributed by a certain lack of emergency response connections (roads) between neighbourhoods, traffic congestion and also emergency apparatus on non-emergency duties.

For Instance , the "Sanjeevni 108" ambulance service commenced by the central government

in order to offer instant help to sufferers in times of emergency and those who are injured in avenue mishaps, deal with this critical difficulty of visitors jams, and more often than not this puts patient's life at a grave risk.

As consistent with the "Goldend Hour" concept a victim of the street mishap must be delivered to a hospital or a nearby clinic inside an hour , increasing the possibility of survival.

The "Golden Hour" term was coined by "WHO" (World Health Organization), which is observed everywhere in this world. A consistent with the said idea if an affected person of the avenue of mishap or when a heart patient is hurried to a clinic within an hour, the victim's probability of survival substantially increases by 70-80% .

Consistent with the facts, In these last 6 months at least 1200 individuals of any given district were brought to the hospitals in "Sanjeevni 108" ambulances, where 12 had died in the ambulances due to being stuck in a traffic jam within the city. Other than patients of street mishaps, heart related problem cases also need to be rushed to the nearest hospitals as early as possible. However, due to such traffic jams , people are now not bothered in the slightest to present way for the Ambulances, many such sufferers additionally have lost their lives before even reaching a clinic or the hospital.

Incorporating techniques associated with large vector valued networks which will help in reducing this problem of delayed response hereby saving lives and damage of property.

1.3 OBJECTIVES

To make an application that has the real life application of saving lives by reducing the amount of time taken for the first responders to reach the scene. Although this might seek like it's enough but in a country like India the main trouble lies ahead. Either the doctors aren't available or the necessary equipment is missing and all of this amounts to nothing. However, doctors referring to the other hospitals wasting those precious moments of the golden hour.

This will inevitably lead to the loss of life. Wouldn't it have been much more plausible and efficient that you determine beforehand whether the hospital is readily equipped to deal with the injuries of the victim or not. If not so then the application will automatically direct towards the hospital having much better chances at survival.

What this application hopes to accomplish is to bring about a change in how at the core level these ERS (Emergency Response Services) comes along to save lives . With the evolving times it is necessary for ERS to be readily equipped and follow the fore mentioned application in order to lower the death toll count which is avoidable in the least.

The application requires an extensive database that will revolve around all the hospitals in vicinity, giving information about the doctors that they have hired, their field of specialisation, also regarding the equipments that they have equipped. Moreover the objective also delves into placement of the ambulances in a widespread area such that its far easier to reach the site of distress or accident well within the time frame rather than keeping all of them in the hospital and they have to make the long journey back.

Propose the solution to delayed response of emergency services due to traffic congestion in high density areas by finding the shortest route to the path, which doesn't include high infrastructure input, which is comparatively cheaper and more efficient than the existing solutions.

We shall also take into account various factors such as traffic congestion, road blocked along with the distance involved making it a vector valued approach.

1.4 METHODOLOGY

There are continuously attempts to enhance response time, however not often will we have a an opportunity to look at all the components of equation . In order to improve the reaction time , technology has a pivotal role to play .

It's important to understand that reaction time is usually divided into three main categories:

1.Dispatch time: It is the time elapsed from the moment you get the call to the time all the units get dispatched

2.Turnout time: Time elapsed from when devices are notified till they are responding.

3.Travel time: Time elapsed from while units reply till they arrive on the incident scene.

The fire department however are completely focussed on improving their journey time, as it's very well documented that there is very little can be done in order to improve the rest of the components. Fireplace-warring parties mistakenly accept it as true that with enhancing reaction time is made faster by way of riding faster. This solution does not often have a positive effect; in reality, it could result in much more disastrous results.

But the use of technology as an alternative to enhance response times can alternate all that.

1.4.1 Dispatch Time

It is one of the essential areas wherein to lower the reaction times . The first respondents "Dispatchers" acquire a call if there is an emergency, its very important for them to realize the severity and the nature of the incident ,and considering all of this dispatch the most appropriate resources to deal with it. Unfortunately it isn't unheard of that the technical rescue and these hazmat situations are down told during the intial dispatch because dispatchers aren't at ease while handling an incident as such.

"Computer-aided dispatch" (CAD) and "response interrogation software" will be determential in recognizing the high risk scenarios which are potentially hazardous and these will also help in dispatching the appropriate resources the first time around.It shows how effective the technology is when one is able to send just the correct amount and the type of resources to deal with the incident.

In order to optimize and improve the overall performance there are additional technological improvements that can surely be made. Nowadays , with computer-generated voice we have the means of establishing a pre-recorded audio database, Emergency services ensure that there are the perfect pronunciation of all the roads ,various landmarks ,street names in a given vicinity. Perhaps the best thing about this is that the format of these radio dispatches can be easily customized depending on the geographic location , the incident type and factors as such.

It might feel a little cold and calculated that you are talked back to by a pre recorded message in a robotic overtone , But this eliminates the trivial and the common errors that human dispatchers would have made which might have lead to potentially disaster results.

Since every second counts for the emergency services , with the use of the fore mentioned technology it is possible to shave off those precious seconds of dispatch time. Moreover in addition to the previous merit there are more distinguishable tangible benefits like dispatcher being able to handle a large call volume as the process becomes automated and don't really require human personnel for the job

1.4.2 Turnout Time

Things which cannot be measured or communicated its impossible to improve upon such things. If we our preference are quick responses, we ought to discover other methods to help Emergency Services respond a little faster. Wouldn't it be extremely effective if we place a clock on the wall to indicate how many seconds are left until an established goal is met? The personnel in Emergency services would probably show an significant increase in their performance if they can see how they are doing in real time.

A simple countdown synchronized watch tied to the hand. As soon as an alert is obtained then the circuit that opens the doors and turns on lights is used to initiate the smart watches with the countdown. This clock has to be set up in a conspicuous location inside the apparatus bay. when simplest 10 seconds stay, a chime is activated at the clock to remind companies to quickly location themselves “responding” with the dispatch centre. we have established these clocks in two stations as prototypes to see if effects improve sufficiently to increase the exercise to the opposite 5 hearth stations. Anecdotal evidence demonstrates that the visibility of this device causes wonderful behavioural alternate .

1.4.3 Travel Time

Installing computer systems in these first response institutions is relatively very common than it used to be. These departments have a huge list of options, from adopting mini-computers to in shape in the cab to buying customized, in-automobile computer systems. Regardless of the hardware selected, departments need not forget the use of those computers for equipment fame adjustments. the use of cellular dispatch software program, and the first

respondents would be responsible with changing their statuses .This creates more room for extra records that agencies may acquire whilst respond.

Computer systems with touch-screens or clean-get right of entry to buttons are pleasant as they help to save a couple of seconds of the tour time. It should be mandatory for these respondents to closely study the software program so one can be used to with much ease and less effort with a hint-display environment. a few programs use icons which are too minute and way too precise for any degree of accuracy

In-viechle computers can also include automated automobile place (AVL) gadgets to track hearth branch apparatus in actual time the use of GPS. this may provide precious statistics and allow dispatchers to inform gadgets which can be closest to a received name for an emergency, as a result lowering tour instances.

1.5 ORGANISATION

This file is split into 5 chapters: Chapter 1 is the introduction and it gives a creation of the venture, explaining motivations and goals . Chapter 2 discusses the numerous techniques and strategies which have been used and are currently used for similar hand gesture reputation giving a context to the problem. bankruptcy three discusses the various methods used for development and their implementation. chapter 4 discusses the software artefact evolved and its evaluation through diverse kinds of trying out. Chapter 5 gives a rejection for the assignment and an end discussing limitations and future paintings.

CHAPTER -2 LITERATURE SURVEY

CONTEXT

This Section discusses in further detail the context and background of the project, giving insights into the help of hand gesture recognition, highlighting popular methods and techniques.

2.1 GENERAL

With the advent of projects like smart studies various studies had been conducted to improve the transportation aspect of it. Moreover even existing mega cities facing with the problem of delayed response of the emergency services has made strides to achieve the solution to the above problem.

In current times, there have been many researchers from academia, the industry and governmental organizations that have tried to layout progressive dynamic emergency response and site visitors management systems to lessen the effect of the increasing road site traffic congestions.

But, a select minority of those solutions were aimed directly at the reduction of emergency offerings reaction time. Similarly, they do not keep in mind the vast spectrum of relevant parameters to pick a really perfect variation approach, as a consequence leaving masses of motivation for the layout of the traffic management device proposed on this paintings.

2.2 RESEARCH WORK

This application of optimality in large vector valued networks is relatively a new area of research hence not much literature is available. However many experiments were done and studies conducted to improve emergency services response time, most relevant of these are depicted under as follows.

Soufiene Djahel,Nicolas Smith, Shen Wang and John Murphy [1] have proposed an adaptive traffic management system (TMS) mixed with an indistinct logic based on taking suitable moves for the development of emergency cars creating traffic around their routes.

This is done using a well-designed emergency response plan based on the emergency degree advertised by means of the emergency vehicle and the output of the crowded system. The proposed method has the capability to reduce the unpleasant impact of street traffic when on way to emergency places. widespread simulations had been achieved to evaluate the performance and analyse its effect on the non-emergency cars. As a result it accomplished the goal of device of reducing the travel time of emergency vehicles over the non emergency vehicles. The proposed gadget may be in addition progressed to make it adaptable for using by means of neighbourhood visitors specialists by enabling the introduction of extra septic ERPs and additional metrics (e.g. weather conditions, time of the day, etc.).

Furthermore, in 2012 studies were conducted by **Line Aboueljinane , ZiedJemai and Erven Sahin [2]**. They proposed a simulation version that captures several precise factors of the actual device like time-based arrival charge and tour instances, and objectives to improve the response by way of the SAMU 94 devices through alternative configurations related to the three additives of response time which might be ready, processing and journey instances.

The goal of this paper is to offer the French emergency clinical service of the Val-de-Marne department selection-makers with an efficient and flexible device that allow them to pick out possible problems and to check and look into the consequences of proposed coverage adjustments and to express the results of some selected overall performance measures.

1. For time dependent arrival charge, they developed the use of area software programs simulation version.

2 Small calls aggregation regions

3. Processing instances associated to call kind and severity

4. A tour time calculation module for every feasible beginning and vacation spot with consideration to visitors situations and calls priority

5. Diverse assets and their scheduled shifts

6. The current dispatching policy.

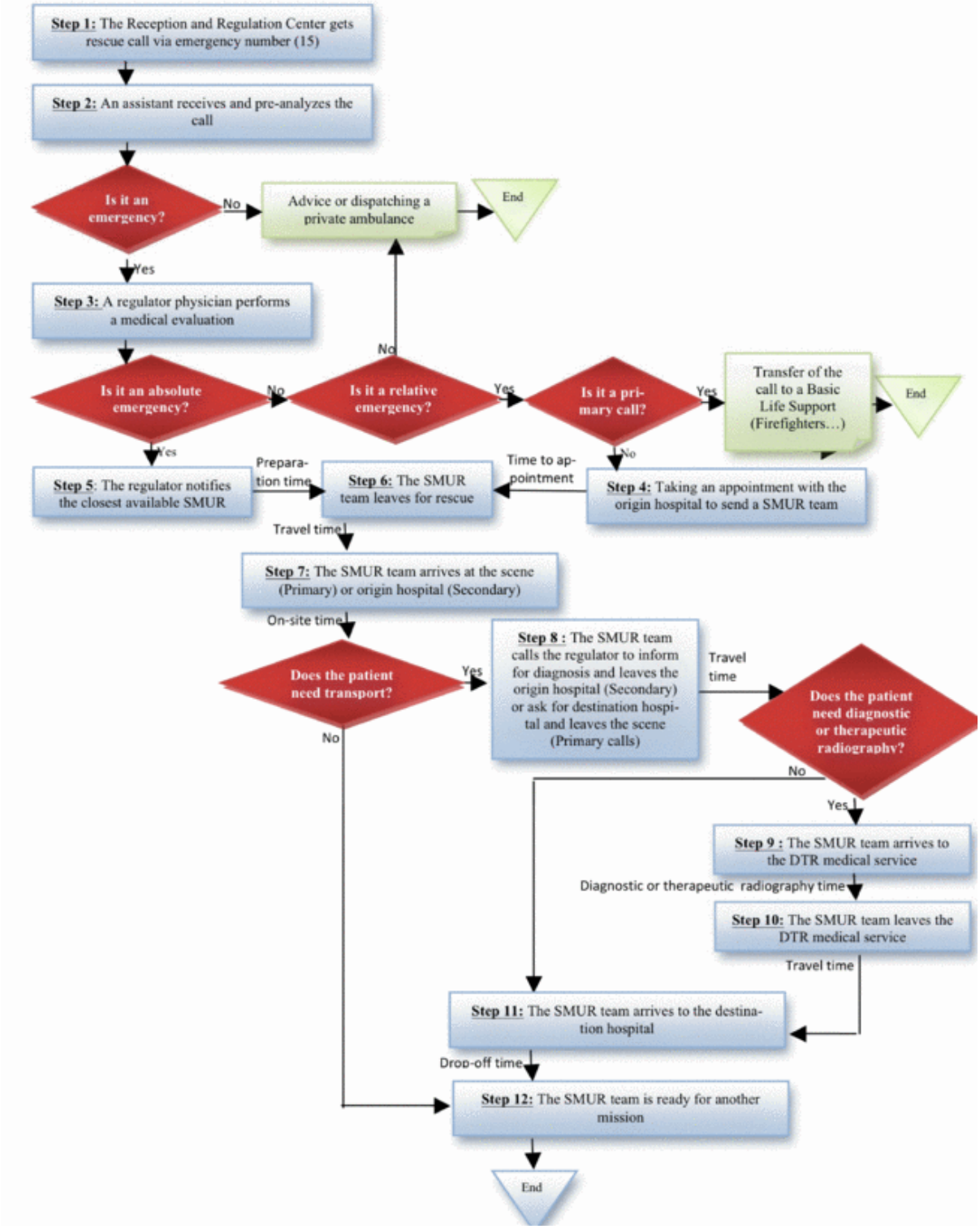

Figure 2.1: Flowchart of the work process (Line Aboueljinane , ZiedJemai and Erven Sahin[2])

As a result of calculations the average percentage of absolute emergency calls reached in 20 min was improved continuously when moving one or two SMUR teams to potential station(s)

from 44% in the current system up to 48.8% with two teams relocated. The 20-min coverage attained greater improvement (49.2%) when the regulation processing time was decreased by 20%.

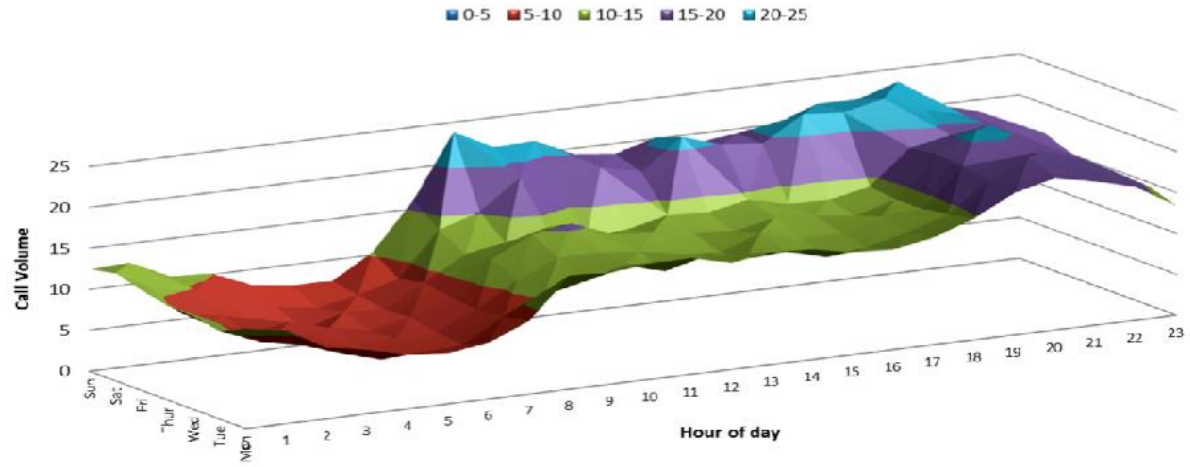

Figure 2.2: Analysis of Call Volume with respect to Hour of day (Line Aboueljinane , ZiedJemai and Erven Sahin[2])

Thus, by integrating a dynamic ambulance redeployment system to the model, it is possible to achieve more considerable improvements in order to favourably locate the SMUR teams after every service start or completion.

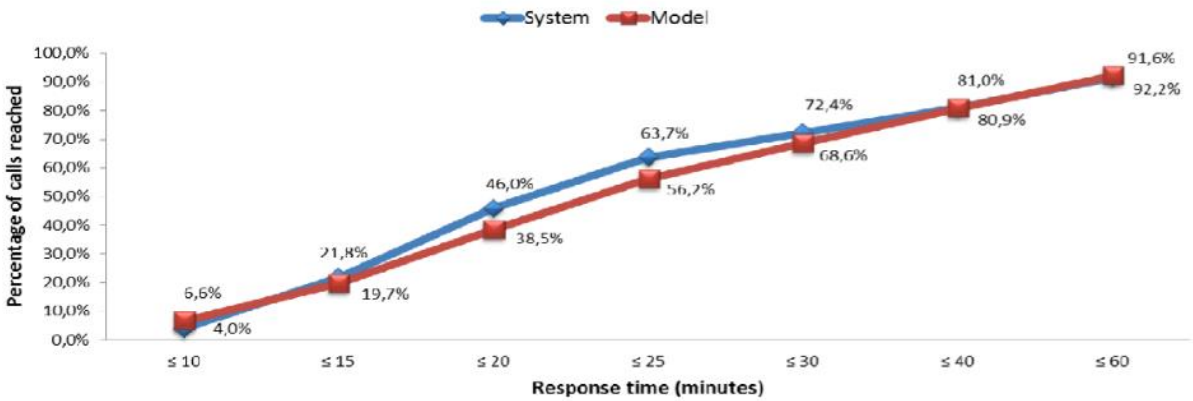

Figure 2.3: Analysis of Calls Reached with respect to Response time (Line Aboueljinane , ZiedJemai and Erven Sahin[2])

Recently, **HairuoXie, Shanika Karunasekera, Lars Kulik [3]** showed that the response time of emergency vehicles can be close to favourable travel time if roads can be pre-empted for certain distances ahead. Emergency vehicles can thus reach their destinations significantly faster than non-emergency vehicles. Experiments were performed based on five parameters namely road network location, move over rule, traffic volume, clearance distance of EMV and travel distance.

Street community regions are selected from three unique locations including the downtown vicinity of Melbourne, Australia, Midtown Manhattan and the 1/3 region is a part of the important London. Thus the road community systems are massively specific among the 3 regions. Assuming that every road has lanes. There exist many variations of pass overrule around the sector. We perform simulations with three variants. The first variant is utilized in Australia. It calls for non-priority automobiles circulate away from the passing lane when EmVs are drawing near. We label this rule as MA. In the 2nd variant, non-priority vehicles now need to move away from the passing lane. This rule is utilized in a few international locations, inclusive of Canada. They labelled this rule as PO. The 1/3 variation offers flexible use of traffic lanes to non-priority automobiles as they could use any lane now not occupied via EmVs. This rule is labelled as FLEX. For each road community, we first evaluate tour time ratios of EmVs with the three versions. The version with the highest tour time ratio is used within the ultimate checks with the road network. Therefore, based on our results, PO is the high-quality version for all the road networks. Traffic has a significant effect on EmVs' reaction time. while checking out the impact of move overrule, clearance distance and tour distance, the extent is about to a default price such that the common traffic velocity fits the real facts. Clearance Distance of EmVs that ask for clearance in a longer distance may also have a better danger to attain their destinations without slowing down. We examine the effect of clearance distance on tour time.

A vehicle that travels longer distance may be hindered by much more vehicles and red lights, which can potentially lead to lower travel time ratio. We evaluate the impact of this factor as well in this approach.

Mervat Abu-Elkheir, Hossam S. Hassanein, Sharief M.A. Oteafy [4] said that vigorous and active emergency response is a critical provider that smart cities have to offer to residents. Emergency control techniques that are currently supported are made to handle

well-understood incidents. however, there are incidents whose nature, shape, scale, and timing aren't as predictable. So, we propose a stepped forward records infrastructure to assist big scale emergencies including multi-car accidents, outbreaks of human or animal sicknesses, essential climate activities, massive fires, and terrorist assaults. The proposed infrastructure will crowdsource the multitude of human and bodily sensing sources that may generate facts about incidents (e.g. smart phones, sensors, cars, etc.) so one can construct a comprehensive information of emergency conditions and offer situational awareness and tips to emergency groups on the scene.

Their infrastructure consists of three components:
(1) large-scale crowd sensing and data quality valuation,
(2) heterogeneous data integration and analytics,
(3) decision making, alternative generation and recommendations.

Leveraging crowd-sensing and heterogeneous data analytics will improve the response coordination to critical incidents and real-time incident control, so as to make contributions to saving lives and lowering injuries, enhancing the nice of existence, and be saving resources by deploying them greater effectively.

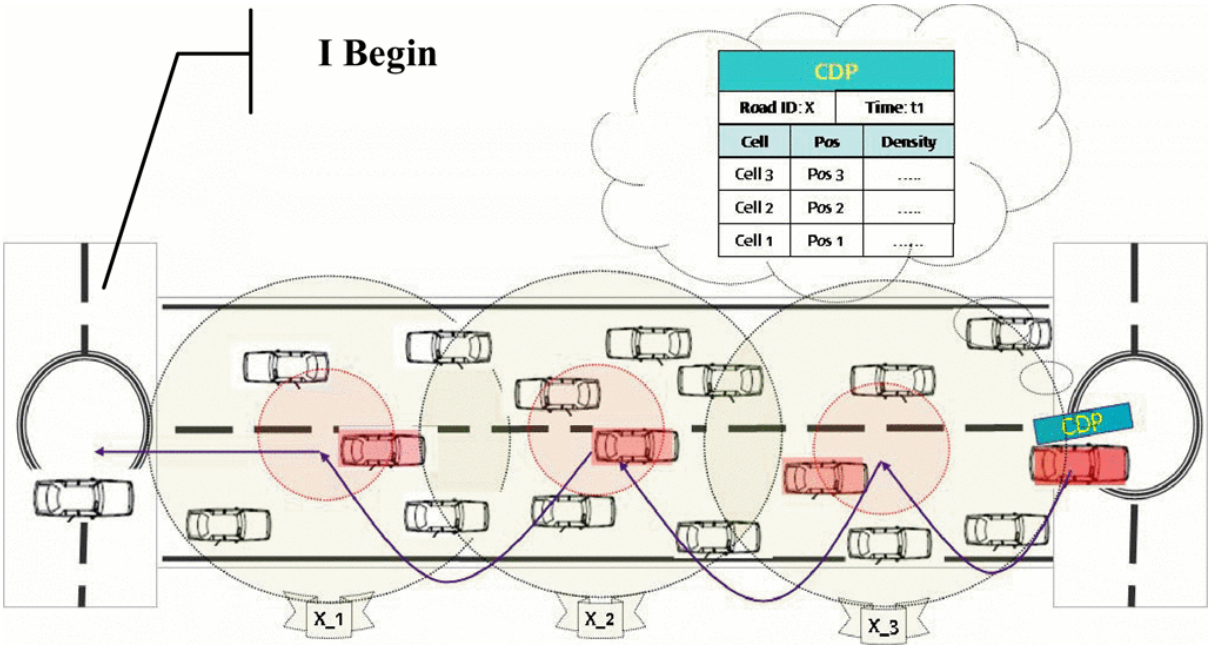

Figure 2.4: Flow of the signal using crowd sensing (Mervat Abu-Elkheir, Hossam S. Hassanein, Sharief M.A. Oteafy[4])

In 2007 **M.Jerbi , Tinku Rasheed and Yacine Gharmi Doudane [6]** provided a totally dispensed and infrastructure loose mechanism to decide the vehicular visitor's density in metropolis environments. The dispensed mechanism is a scalable mechanism that makes green use of the automobiles traversing the intersections to optimally control and pressure the traffic density estimation system. The overall performance evaluation of the proposed mechanism depicted the accuracy of IFTIS and the promptness of facts shipping based totally on delay evaluation at the street traffic intersections. The analysis, performed for exceptional density values indicates that IFTIS can scale properly enough to adapt to changing visitors situations. thanks to its disbursed nature, IFTIS is well perfect for accurate street visitors congestion warning systems and also for multi-hop vehicular conversation protocols. we are presently reading the effect of IFTIS technique in vehicular multi hop routing protocols to investigate the performance profits. We also are great tuning our approach to discover performance loopholes and amplify the mechanism to be implemented to dual carriageway scenarios

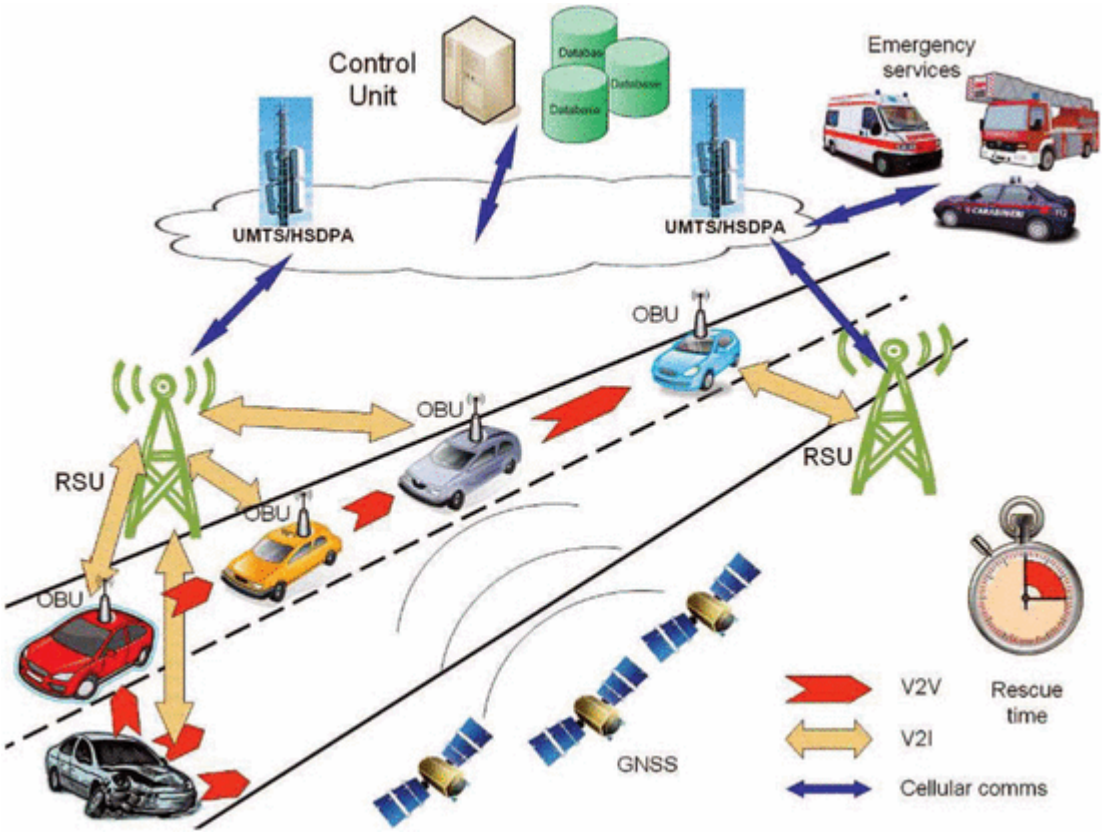

Figure 2.5: Working of the concept (M.Jerbi , Tinku Rasheed and Yacine Gharmi Doudane [6])

Manuel Fogue, PiedadGarrido, Francisco J. Martinez [5] offered the e-NOTIFY system, which allows rapid detection of traffic accidents, improving the assistance of injured passengers through decreasing the response time of emergency services and the submission of applicable facts on the situations of the accident the use of a combination of V2V and V2I communications. This structure replaces the usual mechanisms for notification of injuries, based on witnesses who may additionally offer incomplete or wrong facts in an irrelevant time. The development of a low-fee prototype shows that it is viable to massively incorporate this device in present automobiles. We verified our prototype on the Passive safety branch of Applus+ IDIADA organisation and confirmed how it can correctly detect traffic accidents, reporting all of the unique records to a manipulate Alert gadget on time. future work in this region consists of deploying the gadget in a real environment with the OBUs hooked up in actual vehicles to test the machine conduct when shifting at high speeds.

Francisco J. Martinez and Chai-KeongToh [7] discussed that numerous studies projects led by using studies institutes and car producers around the world have positively impacted the future of IVC systems. Technologies have truly contributed to the trade inside the route of moves to observe after a twist of fate happens, moving from a simple mobile phone name made with the aid of a witness, to the modern-day eCall twist of fate notification system provided in European. In the near destiny, a twist of fate notification systems might be mainly designed for put up-collision rescue services.

Combining V2V and V2I communications, new sensible Transportation structures will emerge with the capability of improving the responsiveness of roadside emergency offerings, and allowing:

(a) direct communication among the vehicles involved in the accident

(b) automatic delivery of accident related data to the Control Unit

(c) an automatic and preliminary assessment of damages based on communication and information processing.

Future ITS based emergency services aim to achieve low level of fatalities while significantly improving the response time and efficient use of resources

Patan Rizwan, K Suresh, Dr. M. RajasekharaBabu [8] proposed a low cost real-time clever traffic management system to offer better service by means of deploying traffic indicators to update the traffic information instantly. Low fee car detecting sensors are embedded in the centre of the road for every 500 meters or a thousand meters. IoTarebeing used to acquire site visitors facts speedy and send it for processing. The real-time streaming records are sent for massive facts analytics. There are numerous analytical scriptures to analyze the traffic density and provide the answer through predictive analytics. A mobile software is developed as a user interface to discover the density of traffic at diverse places and affords an alternative manner for handling the traffic. moreover, our technique is furnished a better end result at the same time as evaluating the present systems. In destiny work now modern-day gadget best detecting vehicle but now not automobile kinds. including greater advanced sensors using for detecting nature of car ability of the car. The primary manner of analytics big data analytics accomplished, making use of diverse advanced strategies to create more bendy to travellers.

.

CHAPTER 3 – SYSTEM DEVELOPMENT

3.1 DESIGN

This software has been created using MVC (Models, Views and Controllers). Model-view-controller (MVC) is an architectural design which creates the application in three logical components: the model, the view and the controller. All of these are built to do specific tasks of development of the application.

The applicationis divided into three interconnected parts in order to separate internal representations of information from the ways data is presented to and accepted from user.The MVC design pattern decouples decouples these major components allowing forefficient code reuse and parallel development.

This software is based on the three tier architecture namely front-end which is responsible for the interface and presentation providing ease of use and better accessibility to the user.

3.1.1 Front-end

The front-end uses some of the latest technologies such Jinja2 which is the default framework for the web development with python and of course HTML/CSS and JavaScript are mandatory for any web application.

3.1.2 Back-end

The back-end is based on the Flask framework of python which sometimes is called as micro-framework of Python for web development, it robust and simple to use and of course the base scripting language is Python.

3.1.3 Database layer

The third layer is the MySQL database, which is the base storage for the software and handles all queries efficiently. The designing of the database was done using the E-R diagram which is shown in the figure below.

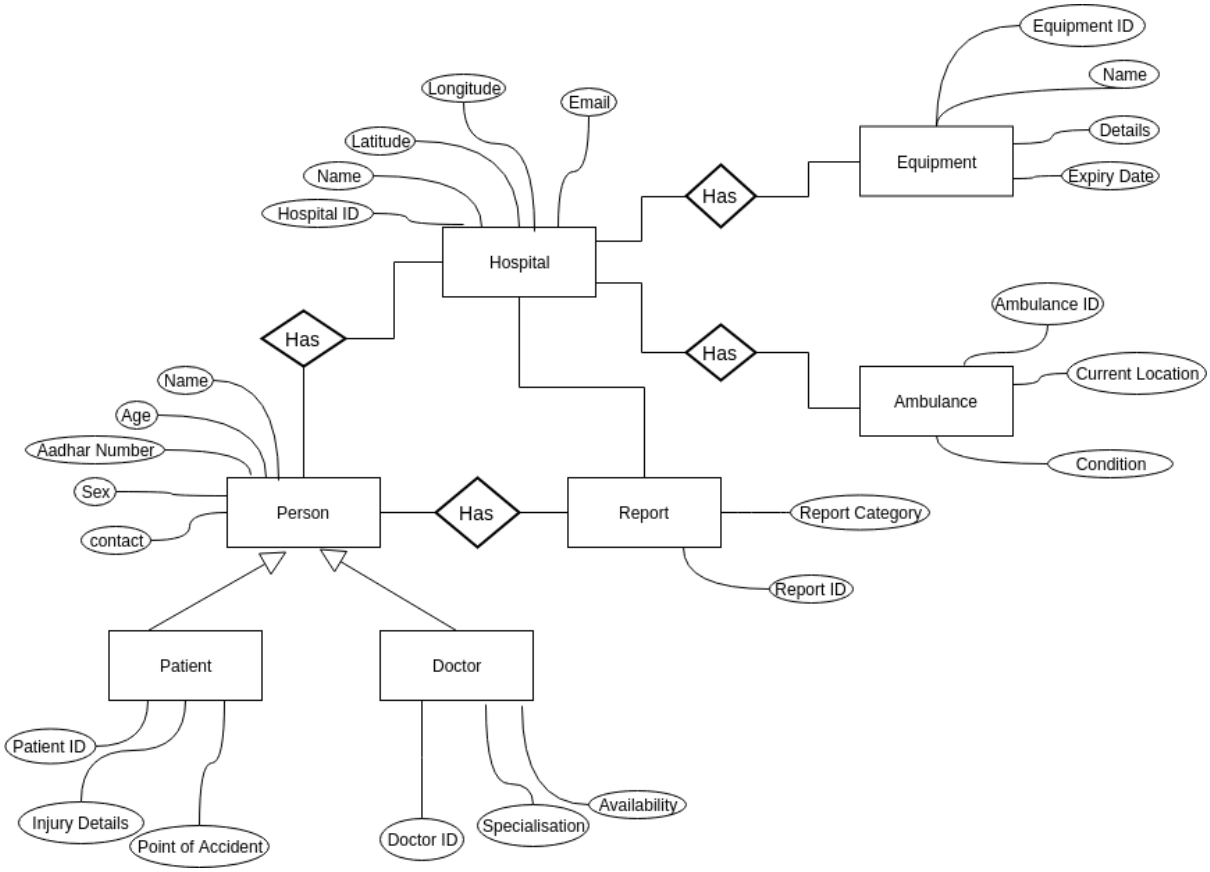

Figure 3.1: E-R diagram of the database of the developed software

The database contains the following tables :

- Doctors
- Equipment
- Hospitals
- Person
- Ambulances
- Report

The more robust form of the above E R diagram can be represented as follows:

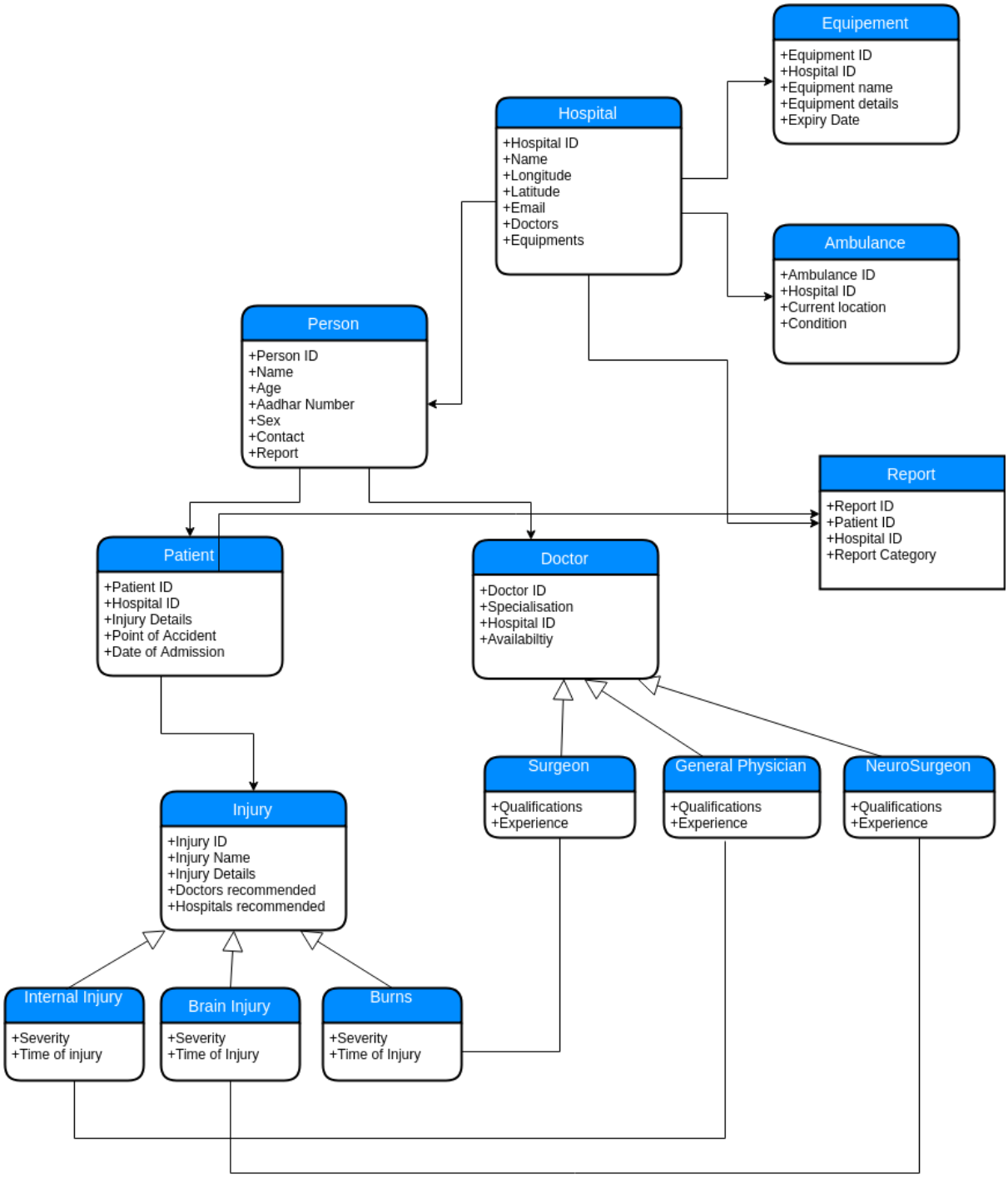

Figure 3.2: Descriptive E-R diagram of the database of the developed software

3.2 WORKING

Following screenshots shows the working of the developed software:

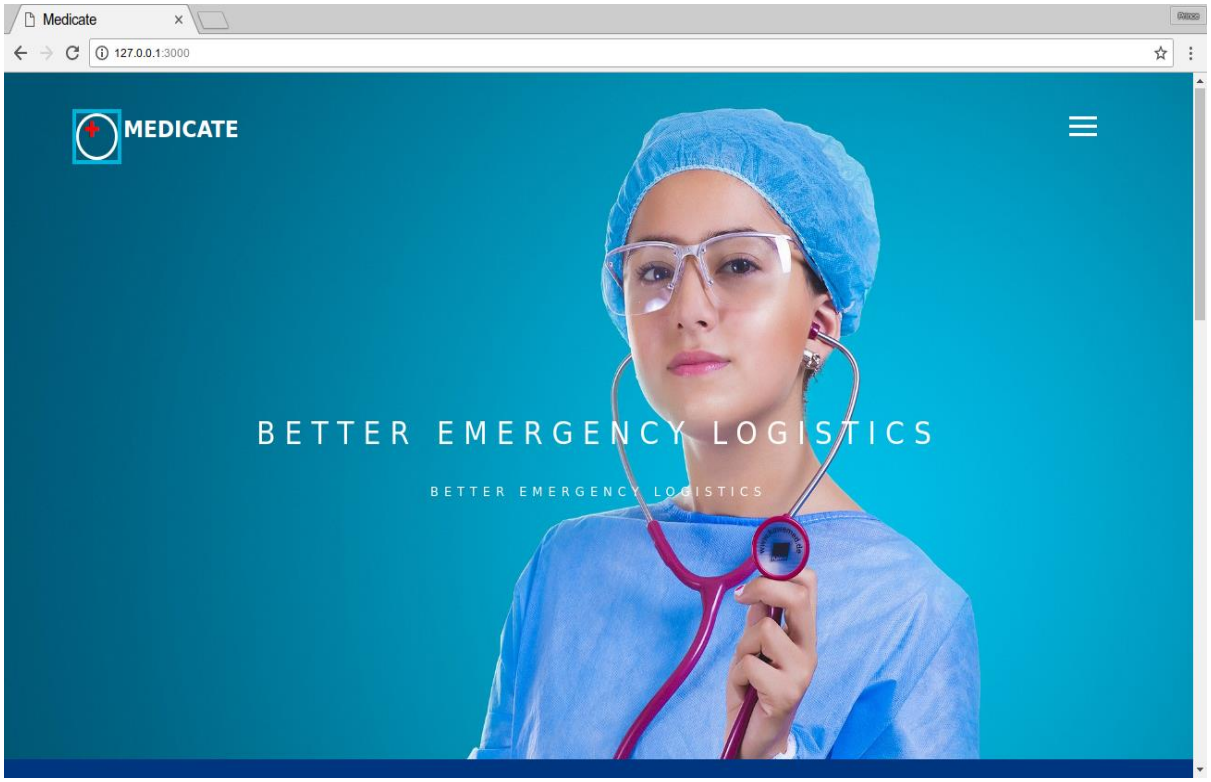

Figure 3.3: Home screen

The above screenshot shows the home screen of the web application MEDICATE built upon Python, Flask, mysql, jinja, html/css and javascript. This is an advanced software which suggests better emergency logistics considering multiple factors. This software is based on the three tier architecture namely front-end which is responsible for the interface and presentation providing ease of use and better accessibility to the user. The software provides a very easy to use interface such that even in critical situations it would not be difficult for the patient or the patient to quickly browse through right options and get the best and most accurate suggestion from the software to have the optimum chances of survival. This software tries to fulfil all aspects of security, scalability and ease of accessibility.

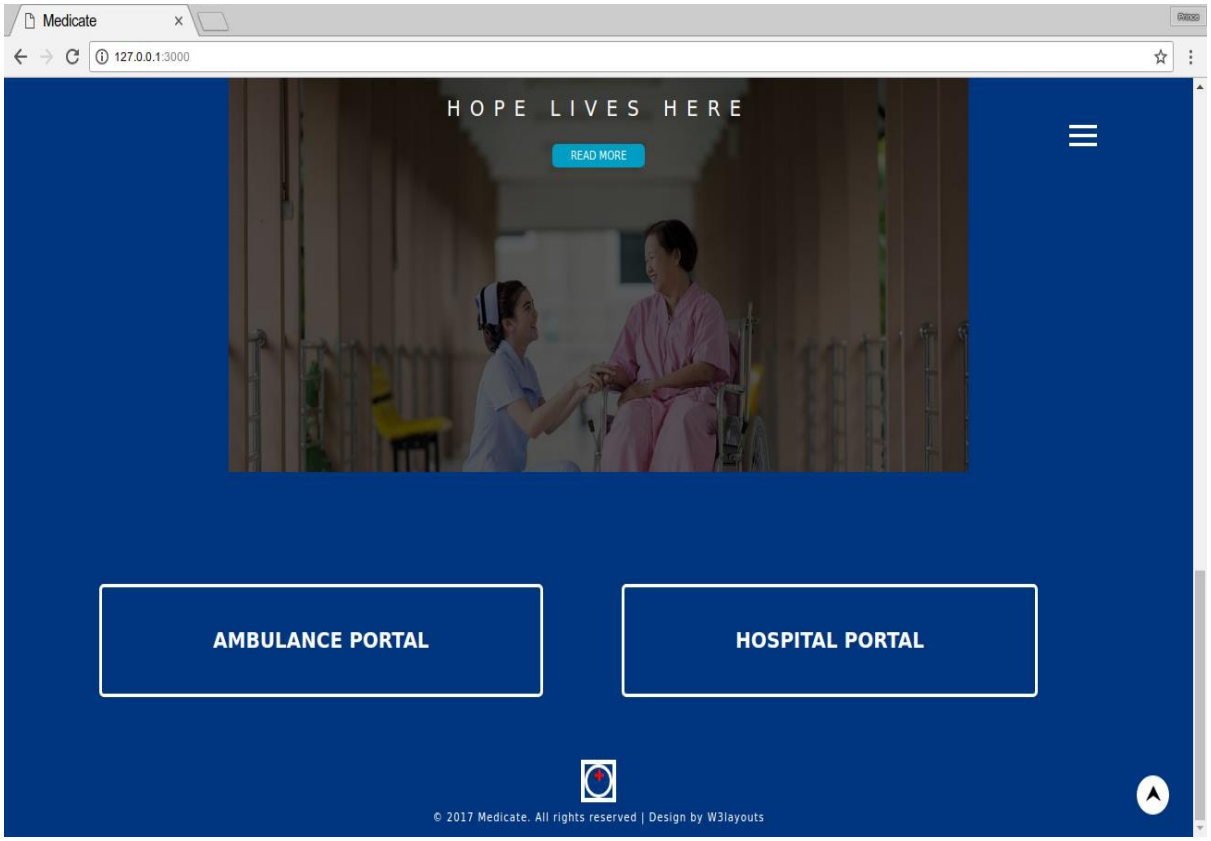

Figure 3.4: Home screen options

The above screenshot shows the web application showing options for both the ambulance portal where the patient or the companion of the patient will get a suggestion from the engine of the software and the other one is the Hospital portal where the hospital get the information regarding the exact locations of the ambulances and the details about the patients on the way to that hospital. Both of these portal would be fully fledged providing all the options required to navigate to get the correct and required information.

The ambulance portal is for the patient or the companion of the patient hence does not requires any authentication layer, to quickly get suggestions of where to go for any particular injury, i.e. getting all the options of hospitals and choosing the best one having highest chances of survival, but would require some preliminary info in order to request any service of getting ambulance or getting advanced services, for example the software might demand for the Aadhar number in order to avail any services that the software offers.

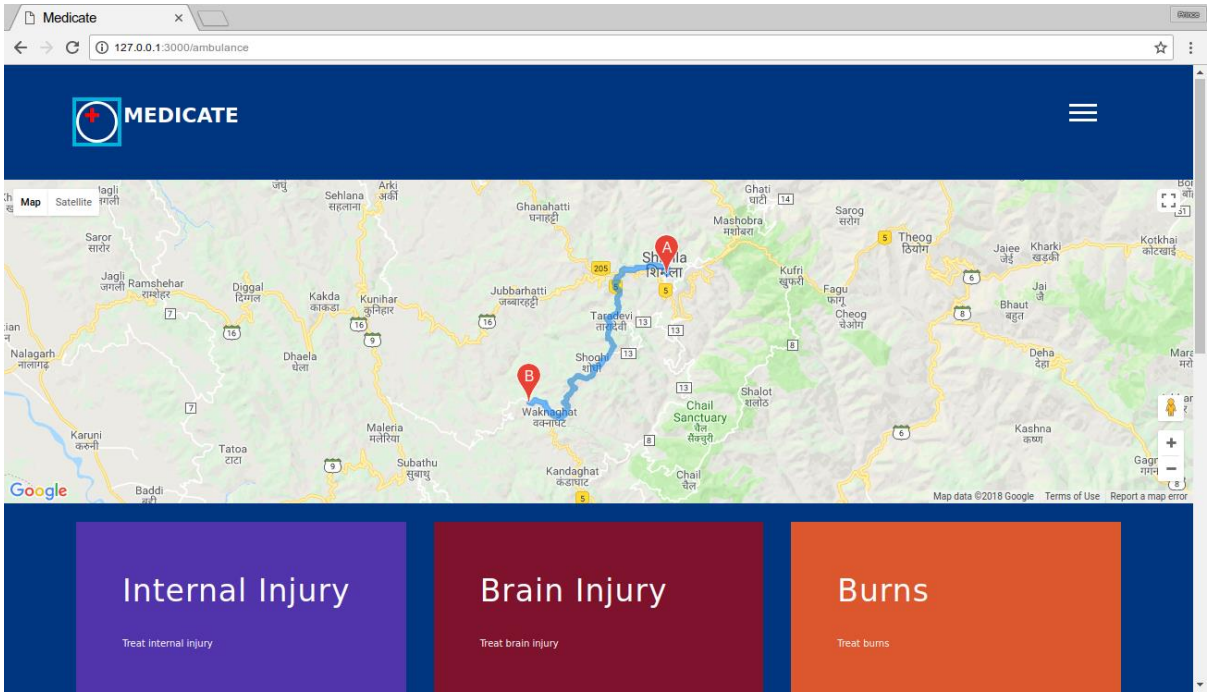

Figure 3.5: Nearest Hospital

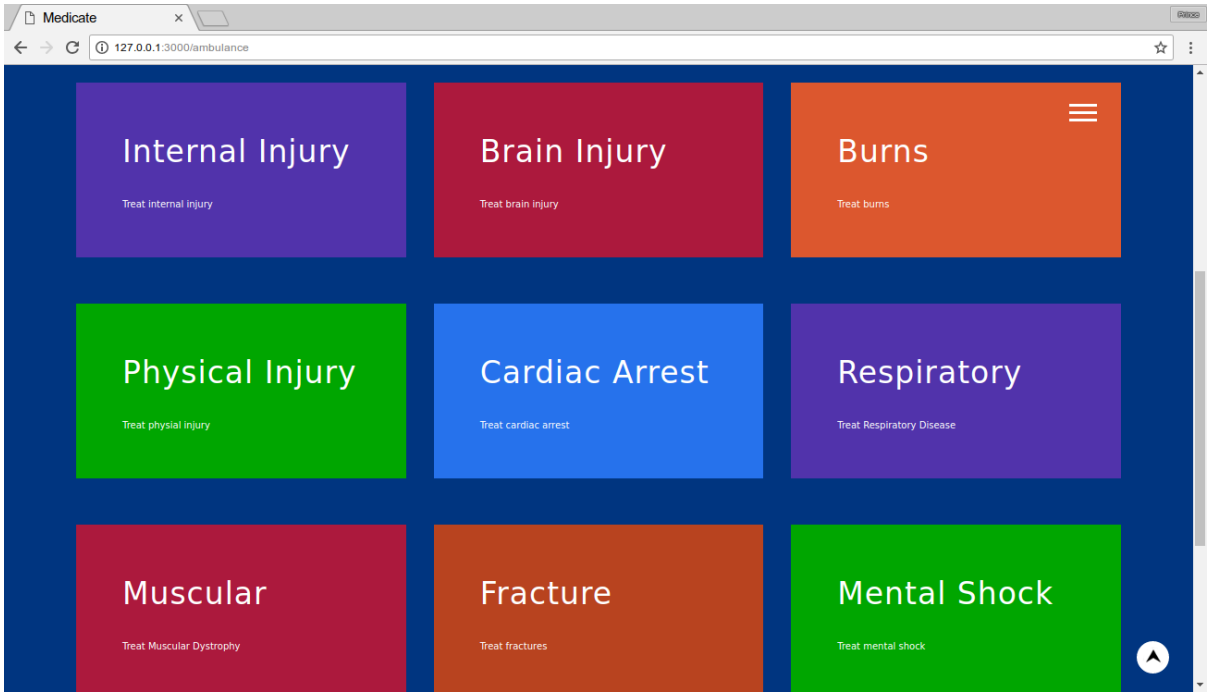

Figure 3.6: Injury Types

The above screenshots show the options given to the patient to choose from to provide the most accurate possible suggestion by the software. The user needs to click on the most appropriate thing he/she is suffering from.

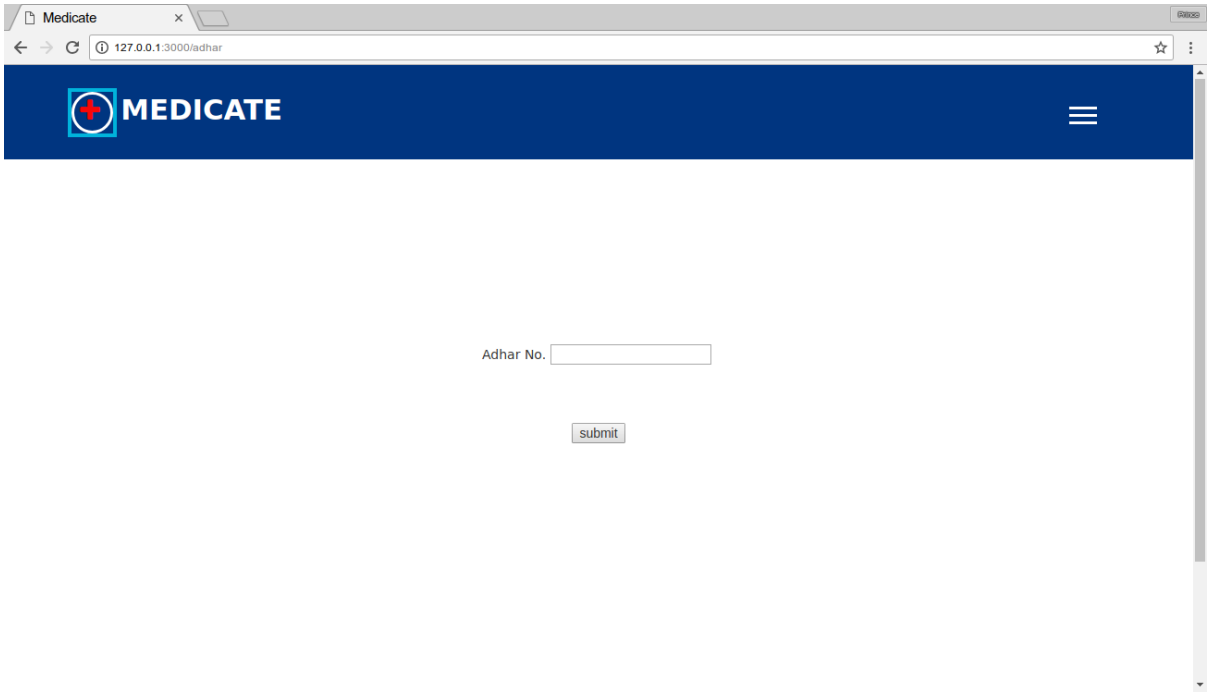

Figure 3.7: Predict Injury using Aadhar

The above screenshot shows the scenario where the patient or the companion of the patient is unable to identify that what has happened to the patient, so this option is given to the patient or the companion so that he/she would simply enter the aadhar number of the patient and a detailed previous medical history will pop up of the patient.

This is an advanced feature, would require a central database of Aadhar to store all the information regarding the medical history of every person whenever he/she visits any doctor, the clinic or hospital must log on to the Aadhar to store the infomation of the patient. Then access of that software must also be given to this software in order to be able to fetch the medical history of the patient and hence give suggestion based on the same. The access to the central server containing all this information can be in the form of APIs.

Figure 3.8: Predicted Result

Based on this medical history of the patient the software suggests the most accurate option that the patient might be suffering from. For example in the above screenshot, the patient has a past record of suffering from increased blood pressure and cholestrol problem, so the software suggests there are high chances that the patient might be undergoing through heart attack. So this suggestion of the software can be taken note of and can be fed again into the software to get the best option for the treatment of the patient. As mentioned this feature would require a central database of Aadhar to store all the information regarding the medical history of every person whenever he/she visits any doctor, the clinic or hospital must log on to the Aadhar to store the infomation of the patient.

The software provides a very easy to use interface such that even in critical situations it would not be difficult for the patient or the patient to quickly browse through right options and get the best and most accurate suggestion from the software to have the optimum chances of survival. This software tries to fulfil all aspects of security, scalability and ease of accessibility.

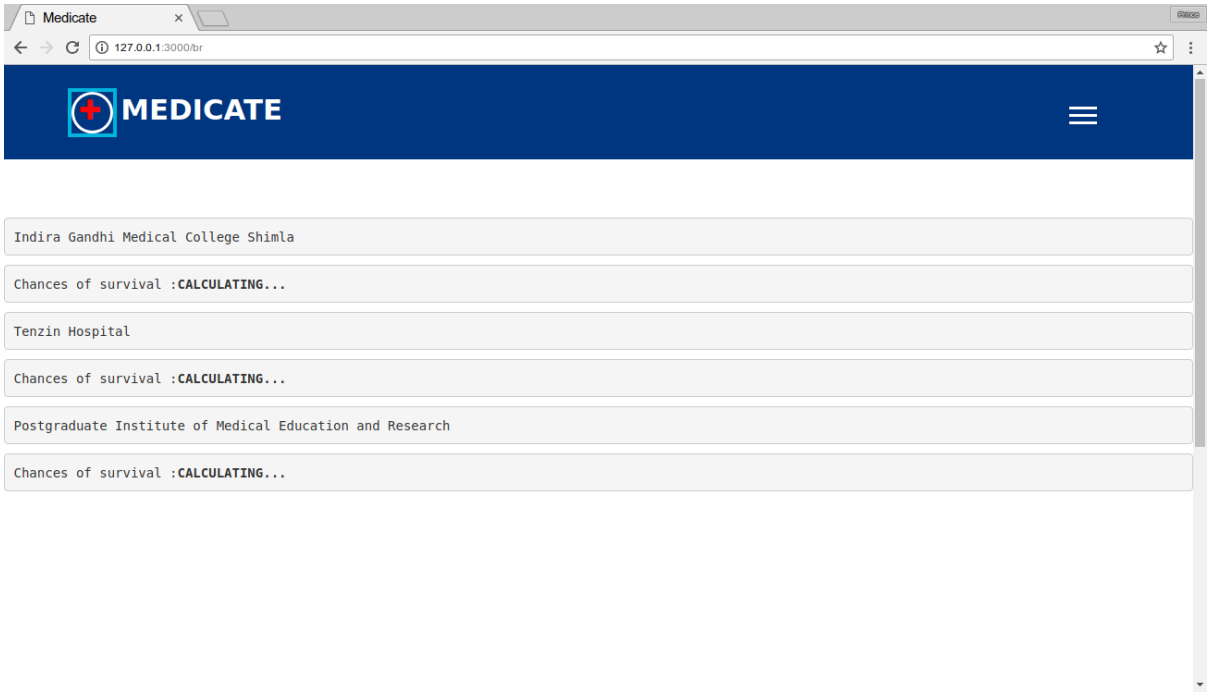

Figure 3.9: Calculating chances of survival

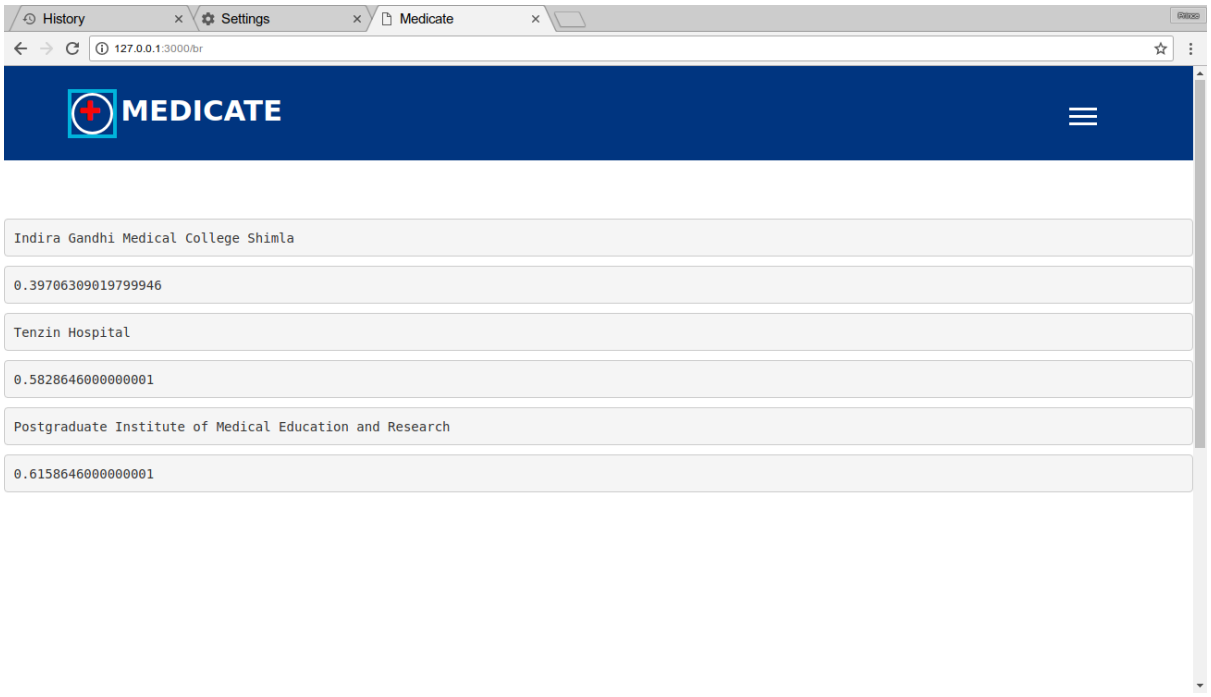

Figure 3.10: Calculated values of chance of survival

The above screenshots 7 and 8 displays the scenario when the software is successfully fed by the inputs it require which are the type of disease and severity(future work) and it implements its algorithm to get chances of survival. Chances of survival is a number between 0 and 1 which converts possibility of survival into numeric values. The higher the number, i.e. the closer it is to 1 the higher the chances or the possibility of survival if used that suggestion of the software. The lower the number or closer it is to 0, the lower is the possibility of survival of the patient if used that suggestion from the software. The software is ultimately going to show all the suggestions from above a threshold of chances of survival to highest possible, the ultimate decision depends on the patient or the companion of the patient to choose the best possible option for them.

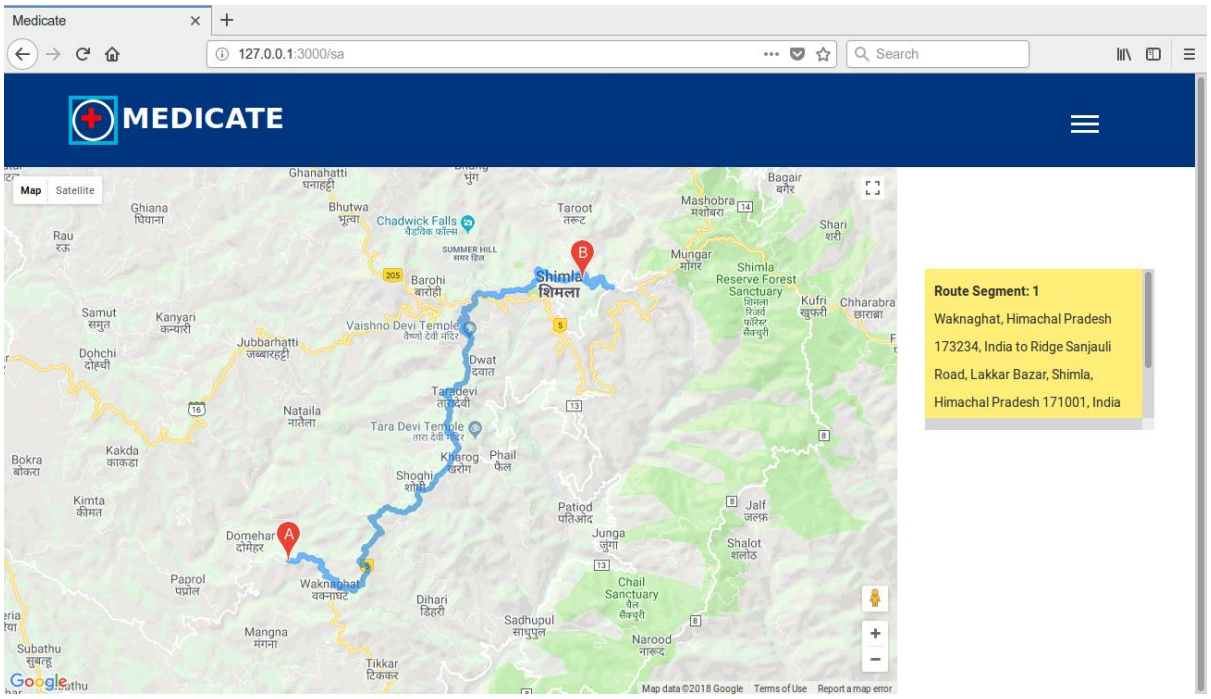

Figure 3.11: Navigation to the best suggested option

The above screenshot shows the redirection of the software to automatically show the best possible option and show navigation options for it as well. The software takes the current position of the user and finds out the shortest path to the hospital for the option which has the highest chances of survival.

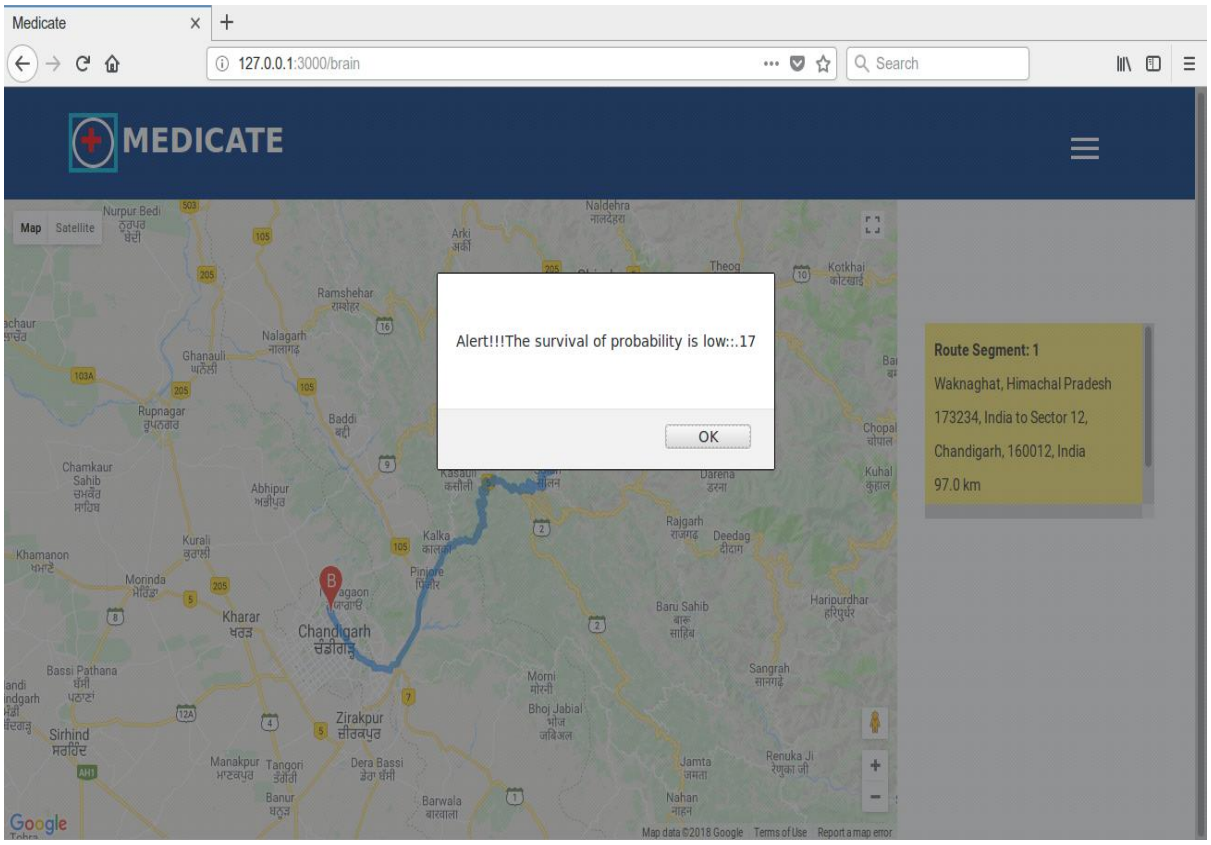

Figure 3.12: Alert for low chance of survival

The above screenshot shows the scenario where in case the chances of survival are very low, software detects that it is below threshold that depends on the policy and alerts the patient or the companion of the patient that the chances of survival of the patient are very low if taken the current suggestion. For example, in the above screenshot the distance from the current location to the best possible hospital is around 97 km which is fairly large, it will take atleast 3 hours to reach there considering the road is hilly, so the golden hour which is the first hour from the time of accident in which the chances of survival are high will be lost, software automatically shows the alert to the patient to find a better alternative if possible.

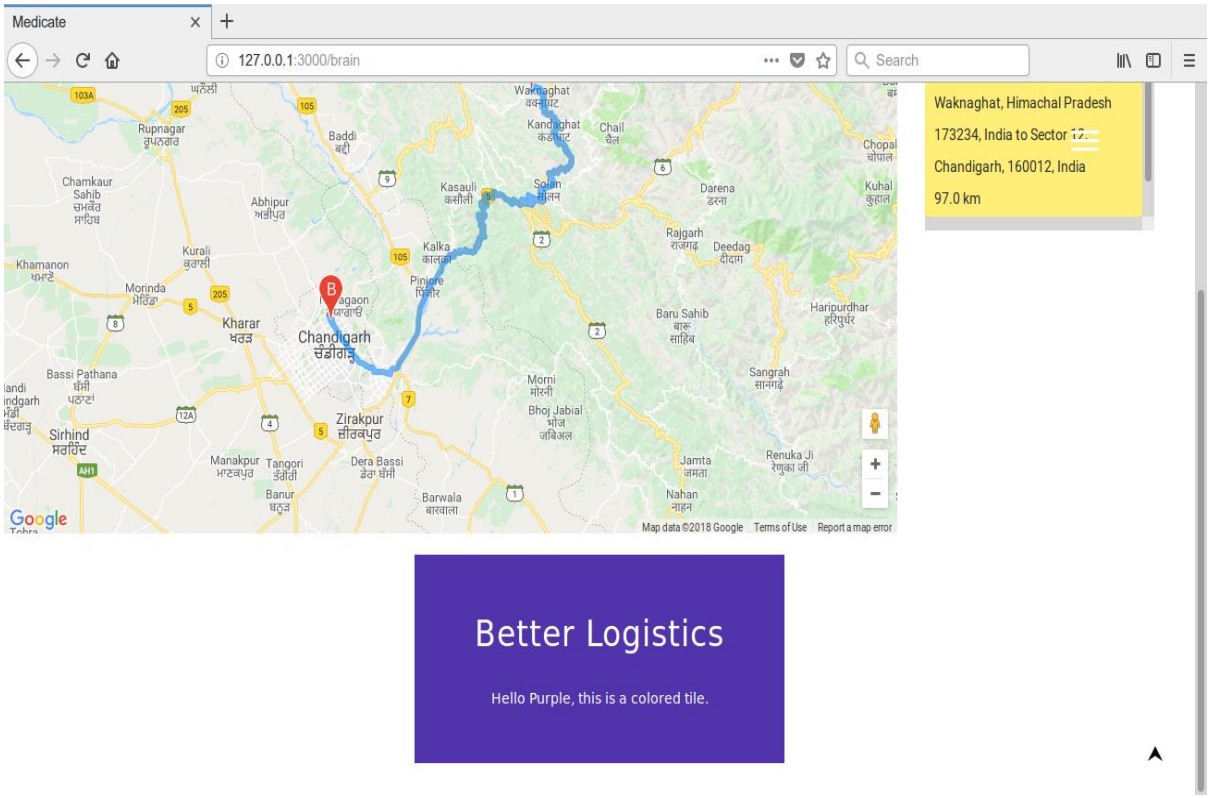

Figure 3.13: Better logistic suggestion

The above screenshot shows the scenario where the chances of survival of the patient are below threshold, so the software shows the patient another option of better logistics, if this better logistics is shown the software will try and find other alternatives to somehow increase the chances of survival of the patient. So when we click on Better Logistics option the software does some processing and comes up with the best possible alternative. If there are no better logistics, that is any better option, or any combination of doctors and hospitals, the alert will simply not be pop up.

The better logistics options considers all possible doctors, hospitals near to the point of accident, it also considers many other options such as the road distance, the severity of accident in order to calculate the chances of survival value to accurately and appropriately to suggest the patient or the companion of the patient with the best possible option.

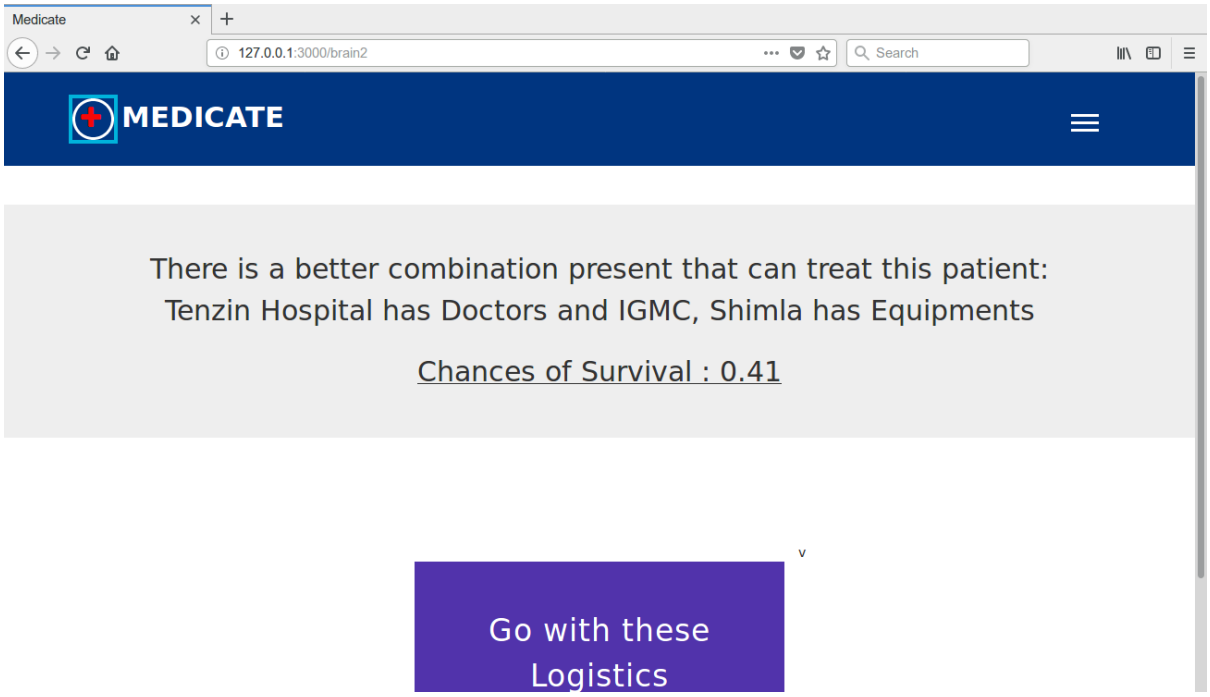

Figure 3.14: Found better alternative

When we click on the Better logistics option the software displays the above screen which contains a better alternative saying "There is a better combination present that can treat this patient: Tenzin Hospital has Doctors and IGMC Shimla has equipments" and hence with these the chances of survival gets increased from 0.17 to 0.41

So if this alternative is chosen the chances of survival is certainly higher and the patient can be saved unlike in the previous case where the software was showing alert regarding the low chances of survival of the patient due to a lot of distance.

So if this option is chosen the doctors in the Tenzin hospital will be notified to reach the IGMC Shimla hospital and their will also show the current location of the patient's ambulance such that the doctor could know the exact scenario. Moreover the IGMC Shimla hospital will also be notified that the patient ambulance is reaching in sometime such that they start preparing for the treatment of the patient.

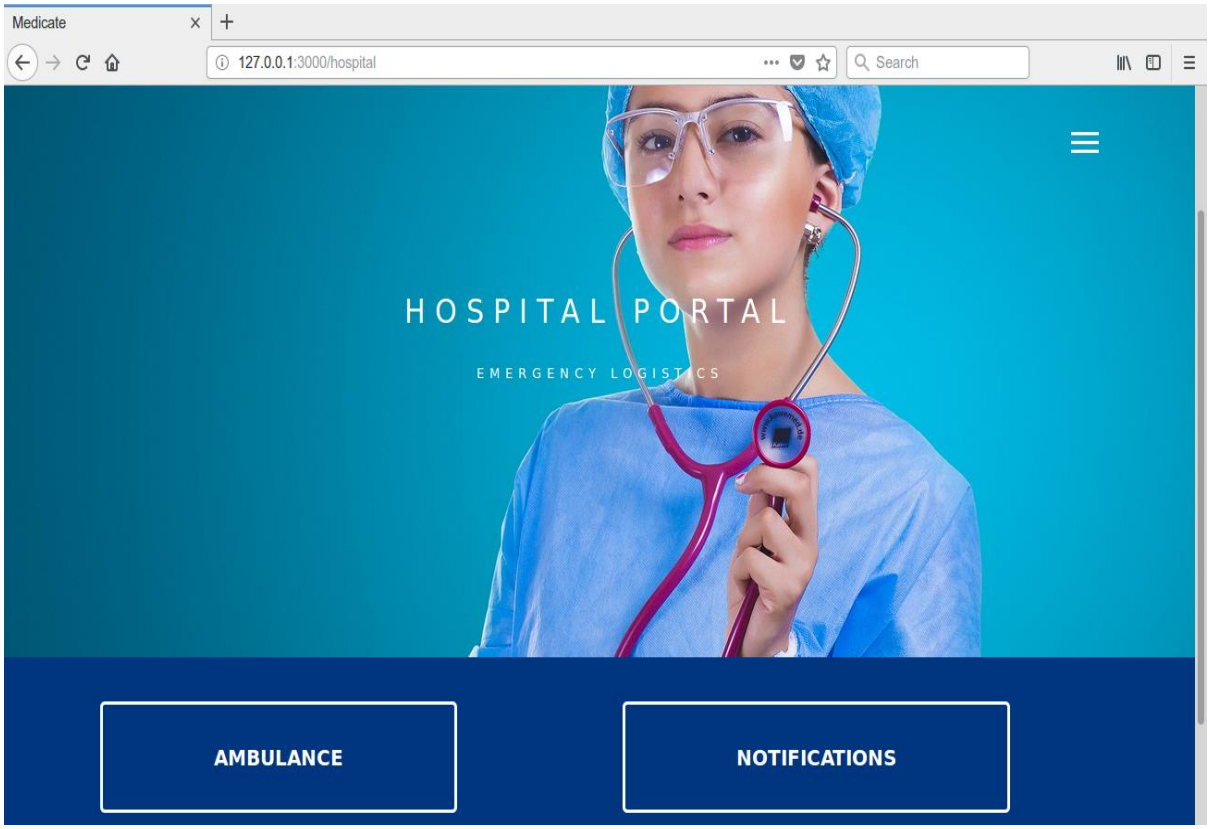

Figure 3.15: Hospital portal options

Till now we have seen the Portal for the patient or the companion of the patient, the above screenshot shows the Hospital Portal and the options available in the hospital portal. There are two options Ambulance and Notifications, the Ambulance option shows the live tracking of the ambulance visible to both Hospital and relevant doctors.

The other one is the notifications board which shows all the relevant notification to the hospital regarding the point of accident, time in which the ambulance(s) are reaching and other relevant information. This portal will require authentication(future work) and will be personalized for every hospital to get appropriate, accurate and relevant information regarding accidents and ambulances.

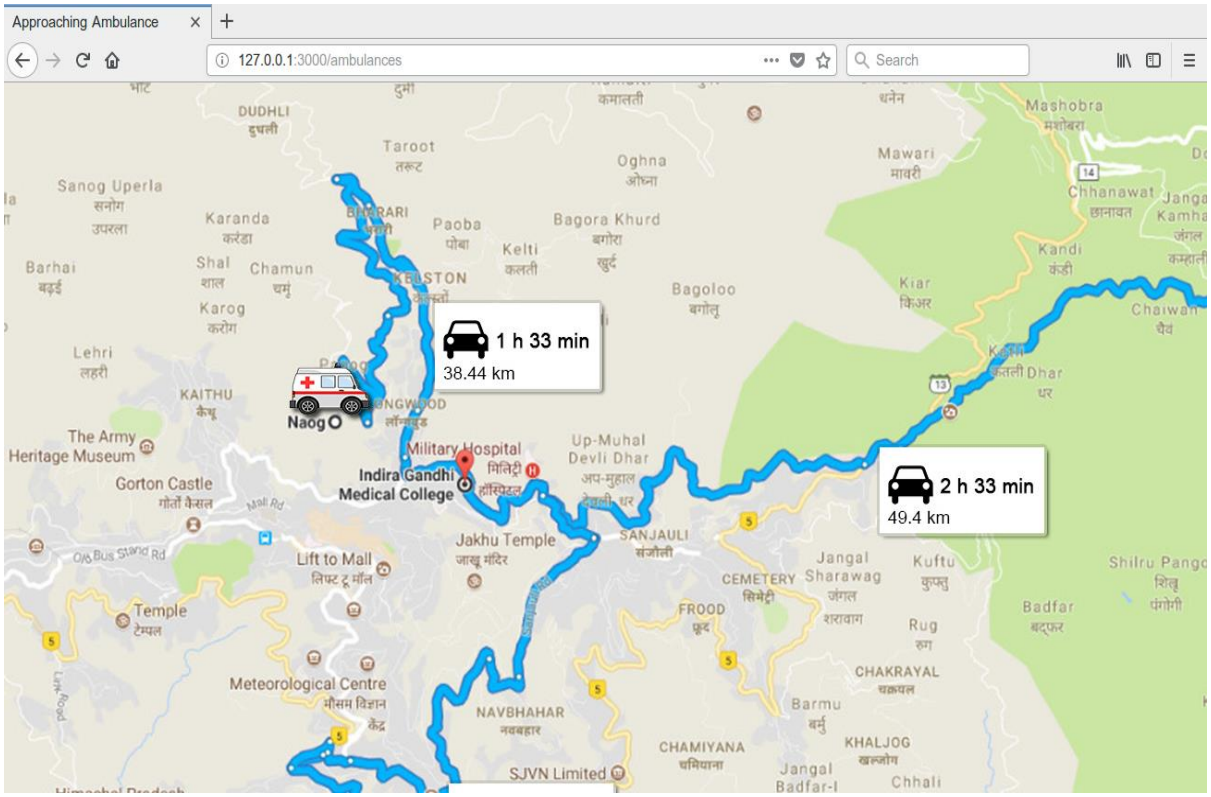

Figure 3.16: Live ambulance tracking

The above screenshot shows the inside of the ambulance option of the Hospital portal, It shows the live tracking of the ambulances (future work) The live tracking is possible using the IOT based smart vehicle tracking system, such that exact real time location of ambulances could be traced. This option of the portal could be made using a third party's map's APIs such as Google.

Google contains a very large set of APIs containing a lot of features, so using them for the sake of the navigation and estimating live traffic would be more appropriate than to start from scratch and create our own map's services and then utilise them here. Live traffic is getting more and more accurate day by day, as more data comes to the server of Google and hence would our application be.

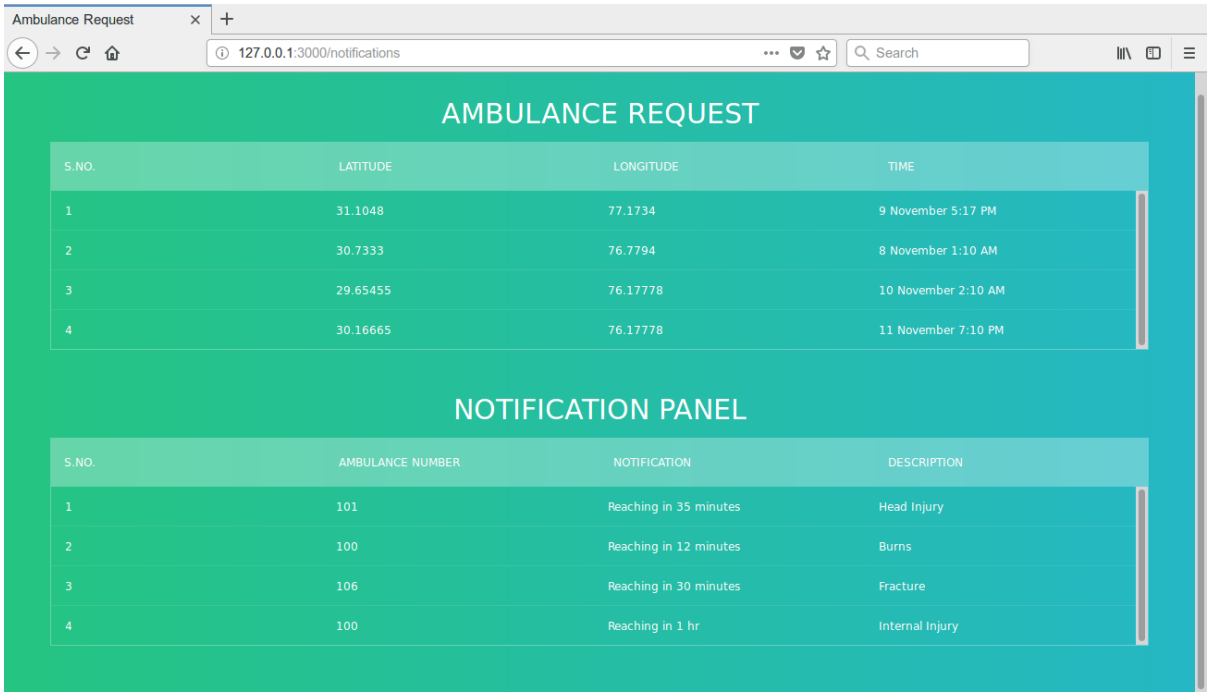

Figure 3.17: Details of accidents and patients

The above screenshot show the inside of the Notifications option of the Hospital Portal, two things are shown inside it, all the ambulance request, containing the location of request and the time of request and second is the notification panel which shows when are ambulances reaching containing a short description of what the patient is suffering from.

CHAPTER 4 - PERFORMANCE ANALYSIS

4.1 SECURITY

4.1.1 Attacks

Even though the micro-framework of python, the flask is very much resistant to maximum attacks, but as we know unbreakable security is a delusion and there is always a few possibilities of a new form of assault. Following are the listing of attacks that are nonetheless feasible to mangle with the security of flask. We've tried to reduce the number of these instances of these assaults and have taken preventive measures.

4.1.1.1 XSS

XSS is an attack that attempts to have your website or application load a malicious script in the browser. This script can then try to access the user's credentials, get cookie data, adjust settings, download bits, etc... One manner to avoid this attack is by using escape text and to validate the user input.

By default, Flask configures Jinja2 to auto-escape all values loaded in the page.

This will cause some performance overhead. although you still have to be considerate towards several scenarios in which you should be careful:

- keep away from sending out information from uploaded files
- avoid using the Markup magnificence on not tested information despatched by a consumer
- keep away from producing HTML without Jinja2
- always quote the attributes values in your templates, whilst Jinja expressions are used within, in any other case an attacker could easily inject either JavaScript code or CSS. more statistics on CSS injection

4.1.1.2 CSRF

Cross-site Request Forgery or CSRF is a form of an attack that uses the user's authentication credentials to execute unwanted moves and one can secure your software against CSRF is to apply a random string and to verify it against a hidden subject.

4.1.1.3 SQL Injection

SQL Injection is an attack wherein users can inject SQL commands via user input form and feature them to be executed at the server. These SQL instructions should do everything: read sensitive facts, adjust/modify the database information, perform administrative duties towards the database server. Your software or application may be exposed to this attack whilst you dynamically create SQL statements (concatenating facts based totally on person's input), and many others. Through default, SQL Alchemy quotes unique characters – semicolons or apostrophes.

4.1.2 Authentication and Authorization

Authentication is a technique that verifies the person's identification, with the aid of validating his / her credential (username / e-mail, password) in opposition to a given authority. Authorization technique verifies whether the authenticated person has got the required permission to a given resource.

4.1.3 Flask-Security

Flask-Security is a helpful extensions that helps to integrate various other Flask extensions and Python libraries:

- Flask-Login
- Flask-Mail
- Flask-Principal
- Flask-Script
- Flask-WTF
- Itsdangerous
- passlib

4.2 OPTIMIZATIONS

Although this software is just a prototype of the actual application. It does not feature the whole extensive database and all the services that are going to be available from it. But when it does, the following are the list of optimization techniques in order to improve the speed and overall performance of the software. These techniques are specific to the technologies used in the software.

The website speed is very important. It could break the success of your site, no matter you provide your users great content and functionality. If your website pages load slower than your competitors' ones, it is possible they get the attention and not your site. Especially when all of the major search engines like fast pages.

There are lots of performance measurement services you could use:

- Google PageSpeed Insights
- YSlow
- WebPageTest

The services above will provide you with tips and tricks what and how can be improved in your site. In this post I will show how Flask allows you to resolve some of the major performance issues in your website.

4.2.1 Compression

Maximum browsers these days support Gzip compression and negotiate for all the HTTP requests. Gzip compression lets in to lessen the size of the response by 70-90%. It is very smooth to accomplish this in a Flask software. The Flask-Compress extension compresses the utility's reaction with gzip.

4.2.2 Caching

Caching statistics in your application lets you to reduce calls to database, additional computation, etc. The Flask-Cache extension will help you resolve this trouble.

There are several distinct cache kinds which you can use: easy, mem cached, redis, filesystem, etc.. The whole listing and its unique configurations can be located beneath the Configuring Flask-Cache section.

4.2.3 CDN

Content Delivery Networks (CDN) addresses these hassles of serving content to users everywhere in the world. They may be large distributed systems deployed in more than one data centers. The Flask-CDN extension provides the developers with means to serve static content from CDNs.

The extension replaces the Flask url_for function. When it is invoked from your templates the flask_cdn.url_for function is rather reffered.

4.2.4 Combine Files

Combining asset files reduces calls to the server, which leads up to the server,which leads to substantial performance raise of your website. The Flask-Assetsextension lets in you to package files to your Flask software.

CHAPTER 5 – CONCLUSIONS

5.1 ALGORITHM

With this algorithm we would be able to find out the fastest possible route from a point in a city considering the distance and traffic as two important factors.

This devised algorithm simulates a sample city's graph and simulates traffic on the roads of this city. This city has many booths for emergency services at various fixed locations in the city. So whenever an accident is reported or there is a need for emergency service, this algorithm automatically devises a list of possible routes and figures out which would take the minimum time considering the real time traffic and the distance. So this is one application of optimization of large vector valued networks.

To achieve this we used concepts from shortest path algorithms such as Dijkstra's algorithm, Bellman-Ford algorithm etc. and implemented them in the optimization of vector valued networks.

5.2 SOFTWARE

This software intends to solve one of the most critical problems of healthcare using the concept of optimization of large vector valued networks. The vector value is the chances of survival of the patient because it is calculated or more precisely calculated optimally using multiple factors such as the doctors available, equipments, the distance etc. We are optimizing the value of the chances of survival considering all possible options and suggesting some of the best to the patient.

With the use of this software, a drastic change can occur in the number of people dying from accidents and minimizing mistakes in the golden hour of the patient. The software tries to minimize any mistakes what a layman could do. The general mentality of any companion of the patient is to take the patient to the nearest hospital, that might not be correct, especially considering the factors such as availability of the doctors at that time in that nearest hospital and equipments. So the non availability of the doctors or the patient might lead that hospital to refer the patient to any other hospital, so there is a lot of time that gets wasted in between getting to the right hospital. The golden hour might get lost in switching from hospitals and the chances of survival drastically decreases in many such cases. The referred hospital people

might say something like “have you brought the patient directly over here, we would have saved him/her” So in order to not encounter such mistakes and save the critical time of the patient and the life of the patient the software intends to suggest the some top suggestions of hospitals and other better emergency logistics to choose from and directly go with one of these suggestions.

This Software uses a parameter chances of survival with every suggestion, the chances of survival is a number ranging from 0 to 1 which the companion of the patient can figure out which option is better and could mix the suggestion of the software with the his/her own conscience and figure out the best option for the patient. The higher the value of chances of survival the better the option is.

The software provides an extensive set of features and is provisioned for some more for future works. The software features an easy to use interface for the patient to be used in the critical times with ease. With the help of some data input from the user, such as the type and severity of the injury, the software starts to process and figures out some of the best possible suggestions. The software also sports a feature to identify what has happened to the patient in case the injury is not visible is the user is unable to identify the kind of injury or disease. In that case, the software simply demands for the aadhar number of the patient to fetch the previous details about the medical history and process this data to come up with the most probable condition the patient might be suffering from.

5.3 FUTURE WORKS

5.3.1 Expand the database

The software is totally dependent on the information it has regarding the hospitals, doctors, equipments, roads, traffic etc. It process the output the basis of these factors.

Some of the information may be provided by third party such as Google might provide information regarding the maps, navigation and traffic using its APIs. And the information provided by Google is most accurate at the moment regarding its maps and traffic services. Some of the very successful organisations such as OLA and UBER also use them to get real time navigation.

But not all information can be provided by third party, as of now. This information include, the details regarding the hospitals, their facilities, the doctors and their availability and more importantly the list of all equipments that a hospital contains. So in order to get that information we need to manually collect all this information, or make a platform where the hospitals are made to fill this information, which is difficult task and would require a many more full stack developers and a marketing and operations team. So this can be a future perspective where a group of people probably a startup can work towards this. Needless to say thestartup will require proper funding to work. Getting the desired information from the hospital and the developing furthur to accomodate and properly utilise that data and provide the services is a manpower intensive task, which would require the startup to correctly recruit, train and fetch work from them.

5.3.2 Mobility

The software right now is a prototype for the web application, which can be accessed through browser only. This aspects provisions the software to be present on mobile devices. This software will be a cross platform application and will be present on all famous platforms such as Android, IOS and windows. This concept is related to tracing location and figuring out other things to proceed further. It is a rare sight that everybody takes their laptop with them, whenever they go outside, hence the service should be available through a mobile device such as a smartphone.

Although a mobile device also has a browser and would be able to fetch the services provided by this software, it might not be fast and integral and dedicated just for this purpose. Hence an Android or IOS app is the best form of this software.

And it is intended to be worked out in future by a team of developers, to seemlessly provide faster and better service of better emergency logistics.

5.3.3 Central server for storing medical history

The concept of central server which will provide medical history will make a lot of tasks easier for the software and the treating entities such as doctors and hospitals. The whole information of what medical operations the patient has undergone will provide a better and

much more extensive view to the doctors and hospitals who are going to treat the patient which will help them understand better the patient and hence treat in a better way.

We also want Aadhar to play an integral role in collecting the medical history of the patient regularly whenever the patient visits any medical facility, but this would only be possible with the permission from Indian Government.

if Indian government does not allow this then a central server containing unique identification of each patient has to be brought into picture. Now the information will be stored on this central server instead of the Aadhar servers. The server needs to be fast and available all time in order to provide data to the software to process and provide better suggestions.

REFERENCES

1. S. Djahel, N. Smith, S. Wang and J. Murphy, "Reducing emergency services response time in smart cities: An advanced adaptive and fuzzy approach", *2015 IEEE First International Smart Cities Conference (ISC2)*, 2015.

2. L. Aboueljinane, Z. Jemai and E. Sahin, "Reducing ambulance response time using simulation: The case of Val-de-Marne department Emergency Medical service", *Proceedings Title: Proceedings of the 2012 Winter Simulation Conference (WSC)*, 2012.

3. H. Xie, S. Karunasekera, L. Kulik, E. Tanin, R. Zhang and K. Ramamohanarao, "A Simulation Study of Emergency Vehicle Prioritization in Intelligent Transportation Systems", *2017 IEEE 85th Vehicular Technology Conference (VTC Spring)*, 2017.

4. M. Abu-Elkheir, H. Hassanein and S. Oteafy, "Enhancing emergency response systems through leveraging crowdsensing and heterogeneous data", *2016 International Wireless Communications and Mobile Computing Conference (IWCMC)*, 2016.

5. M. Fogue, P. Garrido, F. Martinez, J. Cano, C. Calafate and P. Manzoni, "A System for Automatic Notification and Severity Estimation of Automotive Accidents", *IEEE Transactions on Mobile Computing*, vol. 13, no. 5, pp. 948-963, 2014.

6. M. Jerbi, S. Senouci, T. Rasheed and Y. Ghamri-Doudane, "Towards Efficient Geographic Routing in Urban Vehicular Networks", *IEEE Transactions on Vehicular Technology*, vol. 58, no. 9, pp. 5048-5059, 2009.

7. F. Martinez, Chai-Keong Toh, J. Cano, C. Calafate and P. Manzoni, "Emergency Services in Future Intelligent Transportation Systems Based on Vehicular Communication Networks", *IEEE Intelligent Transportation Systems Magazine*, vol. 2, no. 2, pp. 6-20, 2010.

8. P. Rizwan, K. Suresh and M. Babu, "Real-time smart traffic management system for smart cities by using Internet of Things and big data", 2016 International Conference on Emerging Technological Trends (ICETT), 2016.

9. **Convex Optimization**
   Stephen Boyd
   Department of Electrical Engineering,
   Stanford University
   Lieven Vandenberghe
   Electrical Engineering Department,
   University of California, Los Angeles

10. **NPTEL Convex Optimization Lectures**

    http://nptel.ac.in/courses/111104068/

11. **Analysis of total least square problem**

    http://epubs.siam.org/doi/abs/10.1137/0717073

12. **Michigan State University (Dept. of Computer Science and Engineering)**

    http://www.cse.msu.edu/