

# **ST. XAVIER'S COLLEGE**

(Affiliated to Tribhuvan University)  
Maitighar, Kathmandu



**Final Year Project Report  
on  
“Sahaj Ambulance: Mobile Application for On-Demand Ambulance  
Request”  
[CSC-404]**

A Final Year Project Report submitted in the partial fulfillment of the requirement for the degree of Bachelor of Science in Computer Science and Information Technology awarded by Tribhuvan University

**Under the supervision of  
Mr. Vishnu Kumar Rana  
Head of Department  
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**Submitted By:  
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**Submitted To:  
ST. XAVIER'S COLLEGE  
Department of Computer Science  
Maitighar, Kathmandu, Nepal  
August 6, 2017**

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**CERTIFICATE OF APPROVAL**

The undersigned certify that they have read and recommended to the Department of Computer Science for acceptance, a project report entitled “**Sahaj Ambulance: Mobile Application for On-Demand Ambulance Request**” submitted by **Linus Dhakal (T.U. Roll No.: 2689/070) and Pranesh Dhunju Shrestha (T.U. Roll No.: 2693/070)** in partial fulfillment of the requirements for the degree of Bachelor of Science in Computer Science and Information Technology awarded by Tribhuvan University.

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## ABSTRACT

Technology is one of the leading factors in the evolution of globalization. Human lives are being highly controlled by 0's and 1's. In information and communication technology, innovations have become smaller in size, more efficient and often more affordable. Mobile phones have played its role in enabling the mobility of businesses by its extension to entrepreneurship, banking, e-banking and health delivery system. Whether it may be a first grade student or an elderly man in his seventies, everyone spends a certain part of the day with their mobile phone. As a gateway for communication, messaging, entertainment and information, mobile phones have become the expression of the “digital age”.

Certain situations in life require immediate medical care and a fraction of a second delay can drastically change somebody's life. The ambulance service and paramedics are very important in society as they save hundreds of lives daily by responding to emergency calls. Ambulance services provide the equipment, expertise and experience in the emergency intervention, assessment, management and transport of patients in a variety of controlled, uncontrolled, and disastrous situations. However, no proper database of the ambulances is available despite its urgent need for contact in situational crisis. So, integrating the need of ICT with health delivery system, Sahaj Ambulance aims to provide on-demand ambulance service on request. It also seeks to send assistance tips as per the need of the user.

Analyzing the current scenario, Sahaj Ambulance aims to be a great benefit to every single person and overcome the problem of ambulance availability and access in the city. It also carries the potential to bring a breakthrough in the ambulance service which ultimately is connected with human lives. Making impact on the community and digitizing a developing country like ours with the help of a field that no one stays away from helps the country to take a big leap in the use of ICT in this technological era.

**Keywords:** Mobile application for health service, On-demand ambulance request

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## **LIST OF ABBREVIATIONS**

- |         |   |  |
|---------|---|--|
| 1. ICT  | - | Information and Communication Technology |
| 2. GPS  | - | Global Positioning System                |
| 3. HCP  | - | Health Care Professional                 |
| 4. VDC  | - | Village Development Committee            |
| 5. BLS  | - | Basic Life Support                       |
| 6. ALS  | - | Advanced Life Support                    |
| 7. LBS  | - | Location Based Services                  |
| 8. PNT  | - | Positioning Navigation and Timing        |
| 9. IDE  | - | Integrated Development Environment       |
| 10. APK | - | Android Package Kit                      |
| 11. SQL | - | Structured Query Language                |
| 12. XML | - | Extensible Markup Language               |
| 13. DFD | - | Data Flow Diagram                        |
| 14. ERD | - | Entity Relationship Diagram              |

# **CHAPTER 1: INTRODUCTION**

## **1.1 Background**

Sahaj Ambulance is made up of two different words, “Sahaj” meaning easy in Nepali and Ambulance being the vehicle used in the medical emergencies and transportation. This project is named Sahaj Ambulance as it aims at enhancing the present ambulance scenario of Kathmandu valley using the internet and the mobile technology.

Information and Communication Technology (ICT) in the ambulance service generally includes all the related operations carried through electronic and internet technology. Complex electronic devices and the accompanying technologies are being used extensively in developed countries for the ambulance operation. However, the concept is still new to developing countries like Nepal. Nepal’s ambulance service totally relies on the traditional approach of the phone calls and human interaction. While technology is taking over every aspect of human life, technology in Nepal’s ambulance service remains still in a very primitive stage [1].

Information and Communication Technology (ICT) in the transportation service of Nepal is in its very primitive state. While the developed countries have totally adapted to technology for the transportation, very few attempts are being made to implement technology in the transportation service of Nepal. Implementation of GPS in some of the local transportation services and few ride sharing and online booking applications are some of the few countable implementations of technology in Nepal’s transportation service, but as a matter of fact these are all just limited to the capital city [2].

With this present scenario of both the ambulance and transportation service being very new areas of technological implementation in the Kathmandu valley, Sahaj Ambulance aims to bring more technological exposure to the general people and also assist in the operation of ambulance from both the related aspects of it, the patient and the ambulance service operators.

## **1.2 Problem Statement**

Ambulances have crucial importance in Trauma Care, Emergency Medical Services and Emergency Medicine. Studies have found that patient-friendly and proper ambulance services can contribute to reduce deaths among seriously injured or trauma patients. Prompt ambulance service and efficient delivery can avert considerable number of premature death. However, the Ambulance Service in Nepal identifies the neglected aspect of the health service delivery system. Having different contact numbers in different places has created confusion and delay in emergency services. As not all roads in residential areas are adequately signposted, it's very difficult to locate patient's residence in towns and cities [3]. The time wasted during identifying location leads to deterioration of the patient's condition. The crisis in the Operational Management of Ambulance Service System necessitates innovative technical solution [4].

To address the need for prompt, patient-friendly and efficient Ambulance Service, Sahaj Ambulance aims to list all ambulances operating in Kathmandu Valley, take in request for ambulance service, track ambulance on its way to pick up the patients, and provide immediate treatment tips. These services at the tips of their fingers, helps the people in need to break the operational constraint and have efficient ambulance delivery as per their need. It also assists them to adhere to emergency treatment by providing tips. At the present era, when people of every age are found using smartphones to a large extent, there could not be a better option than mobile technology for bringing the implementation of technology in the medical field along with transportation and moreover implementing for the emergency cases, where people's lives are at the line. This project also helps to impact the transportation service of Kathmandu valley which has not been much influenced by the technological innovation in comparison to the other services and aspects of our day-to-day life.

### **1.3 Objectives**

The major objectives of the project are as follows:

- i. List all ambulances operating in the Kathmandu valley and develop an application to request ambulance for service
- ii. Track the requested ambulance on its way to pick up patient using GPS
- iii. Track ambulance on its way to pick up patients

### **1.4 Scope of the Project**

With today's modern technology that is taking a dynamic leap each day, one can easily get access to experts, professionals, and leaders in their fields of interest, around the world at any given time. This project can be implemented by various types of organizations that are related with the health service for purposes such as listed below:

- i. Hospitals for providing information about their services
- ii. Different private and public health-sector related organization to assist people in emergencies
- iii. Organizations with ambulance service to extend their service
- iv. Ministry of Health to enhance their nation-wide health service

Technology has been emerging one of the biggest boon for the human civilization and most of the people are fascinated most of the time with the capabilities of the technology and technology has left no one untouched, from a small kid to elderly people, everyone is being adaptive to technology. Thus, Sahaj Ambulance, in regard of its user scope, has a very wide range. Following are some of the scenarios where Sahaj Ambulance can be of immense help to people:

- i. To request ambulance for service with tracking facility to keep up with the ambulance on its way
- ii. In case of emergencies, where people seek for some home-based treatments while the ambulance is on the way
- iii. To contact and locate different organizations providing ambulance service

## **1.5 Features of the Project**

Some of the notable features that will help in the implementation of this project are as following:

- i. Request ambulance sharing the current location with just a single touch
- ii. Track the ambulance while it is on its way
- iii. Get home based treatment tips while ambulance is on the way so as to prevent the patient's condition from worsening
- iv. Get to contact all the ambulance service providers from a single point of use

## **1.6 Requirement Analysis**

Requirement analysis is one of the initial tasks performed in software projects. It is usually comprised of studying the existing system, data collection, hardware requirement and software requirement.

### **1.6.1 Existing System**

Till date, there are not any mobile based applications incorporating the technological achievements that have been developed for use in Nepal, not even for the capital city. But in contrast, there are applications that have been specifically developed for the ambulance service through mobile phone in other parts of the world. Some of the existing mobile based system for ambulance service have been discussed below:

#### **1.6.1.1 Call Ambulance – Emergency App**

Call Ambulance is a platform where emergency providers have to be on a network. Currently, Call Ambulance is focused on Hyderabad, India. Over time, it will be build out to other places too but even if the user is not in Hyderabad, the application can be used to get user's family informed, build own blood donor friends network and many other features.

Call Ambulance prepares users to respond to an emergency situation by simplifying the process of calling an ambulance. Unlike a regular call for an ambulance service, the application is working with various hospitals to prepare them with user's health records and insurance details prior to arriving at user's location [5].

#### **1.6.1.2 108 Ambulance Mobile Application**

108 Ambulance Mobile Application helps to provide immediate medical attention to the victims by completing first sight procedures like taking photos. Ambulance reaches the accident spot quickly but sometimes may have to wait for official formalities of police. This may cause a delay in providing medical attention to the victim. In such cases, 108 ambulance application can be very useful which allows the ambulance driver or doctor to take photos of the accident scene and forward the same to the emergency responders or police in order to proceed with treatment [6].

#### **1.6.2 Data Collection**

Data collection plays a vital role for the practicality of any project. It generally includes one-to-one interviews, focus group discussion, surveys, life experiences and observations [7]. In case of this project, actual observation of the scenario has played the vital role in the emerging in its idea. The importance of technology in ambulance field was and is still being realized and dreamt of by every individual who has experienced delay in ambulance service during emergencies and problems faced by the traffic scenario of Kathmandu valley for any service.

#### **1.6.3 System Requirement Specification**

The requirements of the proposed system are categorized as follows:

##### **1.6.3.1 Functional Requirements**

- **Authentication Mechanism:** An authentication mechanism is required to allow only authorized users to access the services of the application.



- Real-time Tracking: It should be able to track the location of the ambulance while it is on its way to pick up the patient.
- Data Storage: A database system is required to maintain the record of the available ambulance and the registered users.

#### **1.6.3.2 Software Requirements**

The software requirements for both the development of the project and its operation on the user's device have been listed below:

- Development:
  - Platform: Android Studio 2.3.3
  - Operating System: Windows 7 or higher
  - Processor: Intel i3 minimum
  - RAM: 3 GB minimum
  - Disk Space: 900 MB
  - JDK Version: Java Development Kit (JDK) 7 minimum
- User Requirements:

This project is based on internet connection and availability of GPS enabled mobile devices. Mobile technology has been identified as a potential delivery service agent since it is able to provide services anywhere anytime. This application allows the user to geo-locate themselves and also the ambulance on its way which will be providing service to the user.

The basic requirements in the user's mobile phones for smooth functioning of this project are as listed below:

- Operating System: Android 4.1 Jelly Bean minimum
- Memory on Device: 5 MB for installation
- RAM: 768 MB minimum

## **1.7 Feasibility Study**

Feasibility analysis, in simple words is an analysis and evaluation of a proposed project to ensure if it is technically, economically and operationally feasible [7]. As the name suggests, a feasibility analysis is a study of the viability of an idea. It focuses on answering the essential question of “should this proposed project idea be proceeded?” [8].

### **1.7.1 Technical Feasibility**

The technical issue usually raised during the feasibility stage of the investigation includes the following:

- Does the necessary technology exist to do what is suggested?
- Will the proposed application provide adequate response to inquiries and provide information to the users?
- Are there technical guarantees of accuracy, reliability, ease of access?

The project developed is technically feasible. The application is built in Android Studio platform using Java programming language and can be installed and used on Android phones running operating system with and above 4.1 Jelly Bean.

### **1.7.2 Economic Feasibility**

Developing and deploying this application has a very little economical cost. All the platforms used to develop the application are open source. All the application software is freely available on the internet. The software was installed by downloading from website. The cost of the mobile device depends on the mobile phone. Developing this application is economically feasible as there are no extra or overhead costs that could arise during the development of the project and even after its development. The only cost involved would be the cost of the mobile phones and since the project doesn't need any specific mobile phones, the smartphone being used by the development team can be used to build this application.

### **1.7.3 Operational Feasibility**

The system design and development applies appropriate and timely application of engineering and management efforts to meet the previously mentioned parameters. The technical and operating characteristics are engineered into the design. The application is designed so that it is beneficial in real world implemented system. The user requirements were taken into consideration beforehand, so there is no question of resistance from the users that can undermine the possible application benefits.

### **1.7.4 Legal Feasibility**

The user's and the ambulance service provider's data is safe in the database. No unauthorized user can get access to the user's account as the password has been encrypted using an encryption algorithm. The application uses general data of the user, which is provided by the user and uses general data of the locations provided on the internet hence will not violate any rules and regulations. The references used are noted with their paper published and author names. The project doesn't violate copyright act because with full description of references the authors have documented each and every minor parts thinking sensitively. And in regards of codes, they are coded by the project team members and the copyright solely goes to the team members only.

## **CHAPTER 2: LITERATURE REVIEW**

### **2.1 Digitization of Human Lives**

The digitization of our world has never looked back once it got kicked off few years back, the journey of digitization has always marched forward with abrupt changes in the human lifestyle and the digital trend itself. Looking back at just few years, we ourselves are surprised at every small instances of life how things were done back then and what we are doing at the present for the same. Almost everything we do are now being controlled by chips and boards, what used to be touched and felt is now just visualized [9]. A pocket in the pant has replaced a whole bag pack that used to be carried around, more interesting is that the small device in our pocket has the ability to work more effectively and produce optimal results. And this transformation has never ceased, it is ever growing and developing every time into something better. Looking at how we have changed ourselves in a sub-conscious manner, we hardly find any areas of our lives where we have not let technology intervene.

Digital has been a driving force of change across industries; and the transformation is accelerating. One can measure the pace of digital disruption in months while it takes years for an organization and its people to fully embrace such fundamental changes in the way they operate. Change management is by far the most enduring bottleneck to digital transformation [10]. The digital age is moving at such a fast pace that it is fundamentally transforming the way organizations operate, be it in the private or the public sector, and is requiring them to develop new ways of thinking about service delivery that influence the way operating models are designed.

### **2.2 Impacts of Mobile Applications**

With the world being digital, smartphone is on the top of the list for this cause. Over 1 billion smartphones and 179 billion mobile applications downloaded per year, mobile development is certainly one of the innovative and actively growing sector [11]. The increasing number of smartphone users in the global market has led to a tremendous increase in the number of apps that consumers use on their phones. The mobile app

market is growing faster than a beanstalk. The industry is huge and growing daily, and there is no end in sight. Expectedly, the mobile developer population has boomed, and the number of mobile apps in the market has hit new heights [12]. The Apple App store boasts close to 2 million of these apps while Google play has over 2.2 million Apps. Smartphone users understand the critical role that apps play in assisting clients to get access to essential information. According to these statistics, 52% of the time individuals spend on digital media is on mobile apps [13].

With the survey results coming out as 89% of consumer media time in mobile apps suggest that Smartphone media has gradually increased compared to desktop Internet use and is greater in the most recent quarter. There is heavy usage of accessing apps on mobile devices, due to the accessibility of apps across social networks and news apps - as information is consumed more on mobile as can be seen by the decline in print for media [14]. The major conclusion that anyone can draw is that the digitization has been highly promoted by mobile applications, thus any changes to be brought into actions lead towards the change through mobile applications.

### **2.3 Mobile Application in Health Services**

Information and Communication Technology plays as a vital role in the field of health services. ICT has already established itself as an inseparable part of the health services. With the high level implementation of ICT in health facility in the developed countries, the developing countries are putting on remarkable efforts.

Taking the annual report of Department of Health Services, Nepal Government, the concerned authorities are making attempts to incorporate ICT in our country's health services [15]. Health services are required by every person, sooner or later. Following the day-to-day life, the human body gets through a lot of health determining factors, some good and some bad. At the present time, considering the environment and the uprising level of pollution over the years, the human body is at risk and being vulnerable to various health issues which have now become a global concern and several national and international agencies have approached the concerned national authorities. They

have been trying identify repeated patterns of the urban vulnerabilities and the identification the possible steps to lighten the vulnerabilities [16].

The use of mobile devices by health care professionals (HCPs) has transformed many aspects of clinical practice. Mobile devices have become commonplace in health care settings, leading to rapid growth in the development of medical software applications (apps) for these platforms [17]. Numerous apps are now available to assist HCPs with many important tasks, such as: information and time management; health record maintenance and access; communications and consulting; reference and information gathering; patient management and monitoring; clinical decision-making; and medical education and training. Mobile devices and apps provide many benefits for HCPs, perhaps most significantly increased access to point-of-care tools, which has been shown to support better clinical decision-making and improved patient outcomes [18].

The healthcare centers in today's age need to stay connected to patients' records as well as emergency protocols round the clock. Patients are more demanding; regulations and compliance challenges are increasing. In such a scenario, mobility solutions are helping in keeping patients at the highest level of priority, and are helping in various other ways such as:

- Enhances responsiveness and patient satisfaction.
- Simplify collaboration among mobile staff to deliver better results.
- Removes unproductive time spent looking for some staff or trying to reach them on various devices.
- Increases focus on patient care and documentation.
- Streamlines communication by integrating voice, images and text messages in a single device.
- Improves patient care by delivering messages to the point of care rather than to an administrative location or central nursing.
- Helps to avoid miscommunication and confusions [19].

## **2.4 Ambulance Services: Roles and Responsibilities**

The primary role of all ambulance services is emergency pre-hospital medical care, although they generally provide both emergency response and patient transfer on behalf of the health sector. They provide easy access to health services, particularly out of hours, and contribute significantly to telephone triage and telephone health services through sophisticated communications infrastructure. In recent times it has become apparent that increasing health system pressures cannot be resolved only by adding resources, but must also be addressed with new methods of service delivery. The ambulance service is ideally placed to be part of the first line in the continuum of health care, and can significantly contribute to ‘treat and transfer’ or ‘treat and leave’ programs. By integrating ambulance services into the health system generally, their respective strategic agenda are aligned, increasing efficiency, and providing an opportunity for an ambulance service, with its relevant expertise, to influence the outcome of ‘health’ initiatives [20].

The emergency ambulance service crew includes a technician and a paramedic. Once the paramedics arrive at the emergency scene they evaluate the situation and the condition of the casualty and decide whether to take them to the hospital or just treat them there. One of the important roles of the ambulance crew is to stabilize and treat patients quickly to prevent any mishap before the patient reaches the hospital. They provide immediate and effective life-saving care in a safe and clinical working environment with maximum mobility. They are well trained in first aid skills to be able to deal with profuse bleeding, crush and fall injuries, cardiac arrests, road accidents, and much more [21].

## **2.5 Ambulance Service in Nepal**

There is no complete inventory of ambulance operating organizations in the country. In the absence of this information it is not possible to present a comprehensive analysis of ambulance operation in the country. All the organizations permitted to operate ambulance cannot be presumed to be in operation and many organizations previously operating ambulance may have gone out of business. The study shows that a wide

range of organizations with a variety of attributes are involved in operating ambulance service. The services being provided were also found to be varying in a lot of attributes, such as size, area of operation, range of activities and resource availability [21]. The findings of types of ambulances can be listed as:

- Government Hospitals
- Private Hospitals/ Nursing Homes
- Local Bodies (Municipalities/VDCs/Wards)
- Social Organizations
- Family Trust

Efficient operation of ambulance services require specific kind of relationship engrained in trust, cooperation and collaboration on the part of provider organization, drivers and the users. This relationship is more than an agreement between three parties to cooperate and complement each other in the operation of ambulance service. Rather it is a form of cooperation of three parties that involves active participation of the three parties with each other in the cause of saving peoples' lives. This cooperation involves efficient communication system between the users and the providers and good condition vehicle [22]. It is the management that provides the framework for making the system operate effectively with expected performance. A schematic exposition of the inter-linkages between various parties and factors is illustrated in the figure below:



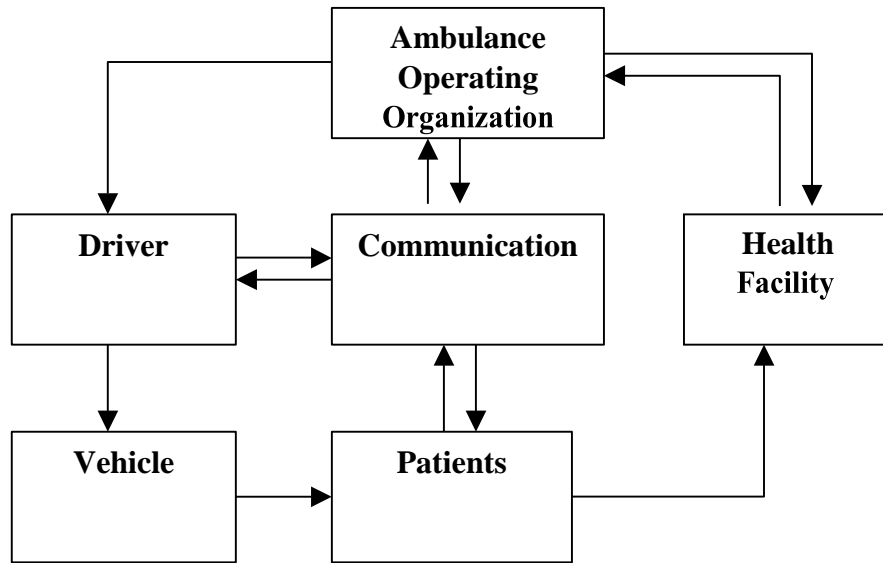


Figure 1: Interlinkage of Various Parties and Factors in Ambulance Management

Communication is a key aspect in achieving the objectives of ambulance service. Systematic communication between the users and ambulance operators not only helps save lives but also contributes to sustainability of service. The ambulance operators need to inform people where the facility is available and how to use it and what to expect [22]. The main channels of information used by the ambulance operators are advertisement in the local newspapers in the city areas. Interpersonal communication is also an important channel in spreading information about the telephone number of ambulance to the community people, particularly in rural areas [23].

## 2.6 Mobile Application for Ambulance Service

Mobile applications act as a single point of information by providing all medical records about the patient, and secure the discussion between the doctor and the patient through encryption, ensuring compliance. With the advancement in technology, increase in smartphone users and the rising health consciousness, mobile apps directed towards this sector have gained tremendous importance. In addition, these apps also help healthcare providers in improving their service efficiency. The demand of mobile healthcare apps is growing day by day, as more healthcare providers and seekers are

realizing the benefits from them. With the help of technological advancements and keen interest in the medical marketplace, more development of mobile apps for doctors and medical experts is taking shape. Mobile applications for the ambulance service are also tremendously growing at the present age. These applications have been built with a lot of features in it. The main purpose of these apps is to book ambulance faster and hassle-free. Booking ambulance is more preferable than wasting crucial time by calling up the ambulance drivers individually[24].

Sometimes an emergency may not just be a road accident. On many occasions, we see people on roads suffer a cardiac arrest. Also, there may be situations like an asthma attack, a heat stroke or even a diabetic emergency. A few precautionary measures which can be taken by us before the arrival of an ambulance can play a crucial role in saving a life [25]. These applications provide all the necessary information and the first aid steps regarding such emergencies. This feature is added to the app because emergency medical services not only require prompt transportation to the nearest health facility but also needs rapid assessment to the emergency situation. These applications have also been designed for patient transport, basic life support (BLS), advance life support (ALS) and mortuary services, also provides flexibility to choose the preferred hospital [26].

Location based services (LBS) are information and entertainment services accessible with mobile devices through mobile network and utilizing the ability to make use of the geographical position of the mobile device. Mobile devices send and receive radio signals with any number of cell site base stations fitted with microwave antennas. These sites are usually mounted on a tower, pole or building, located throughout populated areas, then connected to a cabled communication network and switching system [27].

The GPS is a U.S. owned utility. It provides users with positioning, navigation, and timing (PNT) services. The GPS is actually a constellation of 27 Earth-orbiting satellites. The orbits are arranged so that at anytime, anywhere on Earth, there are at least four satellites "visible" in the sky [28]. A GPS receiver's job is to locate four or more of these satellites, figure out the distance to each, and use this information to

deduce its own location. GPS for mobile communications have been widely applied to collect detailed information on travel trajectory. Nowadays, people can use their cell phones to get direction, track their friends, searching the nearest amenities or keep an eye on their kids [29].

## **2.7 Existing Mobile Applications for Ambulance Service**

Few of the existing mobile applications being used in the global context for providing ambulance service have been discussed below:

### **2.7.1 Call Ambulance – Emergency App**

CallAmbulance is a platform where emergency providers have to be on a network. Currently CallAmbulance is focused on Hyderabad, India. Over time, it will build out to other places too. So part of the application integrating with emergency providers is not implemented in other cities. Even if the user is not in Hyderabad, the user can use the application to get user's family informed, build user's own blood donor friends network.

CallAmbulance prepares users to respond to an emergency situation by simplifying the process of calling an ambulance. The development team believes that pregnant women, parents with infants, cardiac/ neurology/asthma patients can do well to prepare themselves with this app. Unlike a regular call for an ambulance service, this app is working with various hospitals to prepare them with user's health records and insurance details prior to arriving at user's location [30].

### **2.7.2 VMEDO – Emergency App**

VMEDO (formerly Blood For Sure) is the India's Best Medical Emergency app, which assist people during their medical emergencies by connecting to the nearest emergency responder (First aid, ambulance, hospital, blood bank, blood donor etc.).

Application is built with some of the finest features to assist people during medical emergencies and few features to encourage volunteer activity. In addition to adding a lot of features and functionalities at most care is taken to make it user friendly, quick,

light and secure. The app provides services for first aid, finding ambulance, finding nearby hospitals, health tools, emergency button, profile and social sharing to name a few [31].

## **2.8 Comparison and Analysis of Tools**

Android Studio was used to build the application. Android studio is the leading IDE (Integrated Development Environment) for android application development. There surely are other IDEs such as Eclipse which helps in building Android development but Android Studio stands above all. Android studio is also the official IDE for Android application based on IntelliJ IDEA development after the declaration on Nov, 2014[32]. Android Studio offers flexible Gradle-based build system, build variants and multiple APK (Android install package) file generation, code templates to help to build common app features.

Android studio features a sophisticated interface design perspective where the developers can view the interface the developer is working on and its related components.

### **Build Tools**

Android Studio utilizes the Gradle build system. Android's Gradle includes a Groovy DSL (Domain-Specific Language) that allows for scripted builds [33].

### **Advanced Code Completion/Refactoring**

Android Studio has deeper support for specific Android code completion and refactoring than other IDEs. Android Studio is based on IntelliJ which features a more “intelligent” auto completion algorithm and predicts better what you want to do. Android Studio is definitely superior in this area.

### **User Interface Design**

Android Studio features a completely redesigned user interface design tool. Android Studio's UI tool has more customization options and is more responsive.

### **Project Organization**

Android Studio uses Modules to organize your code. The advantage of modules is that modules have their own Gradle build files and can declare their own dependencies [34].

### **IDE Performance/Stability**

Android Studio can make the project in thirty seconds which would have taken a minute or two in Eclipse under the same configuration of the system [32]. Android Studio is constantly improving itself and with the release of new updates frequently, the current version of Android Studio provides a very good experience to developers in comparison to other IDEs. Seen as all in one package, Android Studio provides more stable performance guarantee than other IDEs.

MySQLi was used to create database for the application. MySQLi was most appropriate for this application since it server-based.

MySQLi is a popular implementation of accessing a database using that query language and so is SQLite but that's a 'lite' version which is commonly used to embed in applications. MySQLi is mainly used for managing data of websites. [35].

## CHAPTER 3: SYSTEM DEVELOPMENT

### 3.1 Project Management Tools and Strategy

Project management can be defined as the process of applying knowledge, skills, tools as well as techniques to project activities to meet the project requirements. According to Project Management Institute's "A Guide to the Project Management Body of Knowledge", project management processes can be categorized into five groups- initiating, planning, executing, monitoring and controlling and closing [36].

#### 3.1.1 Work Breakdown Structure

A work breakdown structure organizes a team's project into manageable sections. It defines the project into manageable chunks that a project team can understand. Each level of the work breakdown structure provides further definition and detail. In simple words, it is an outline map of the particular project. It is also used to identify the potential risks and their feasible solution [37].

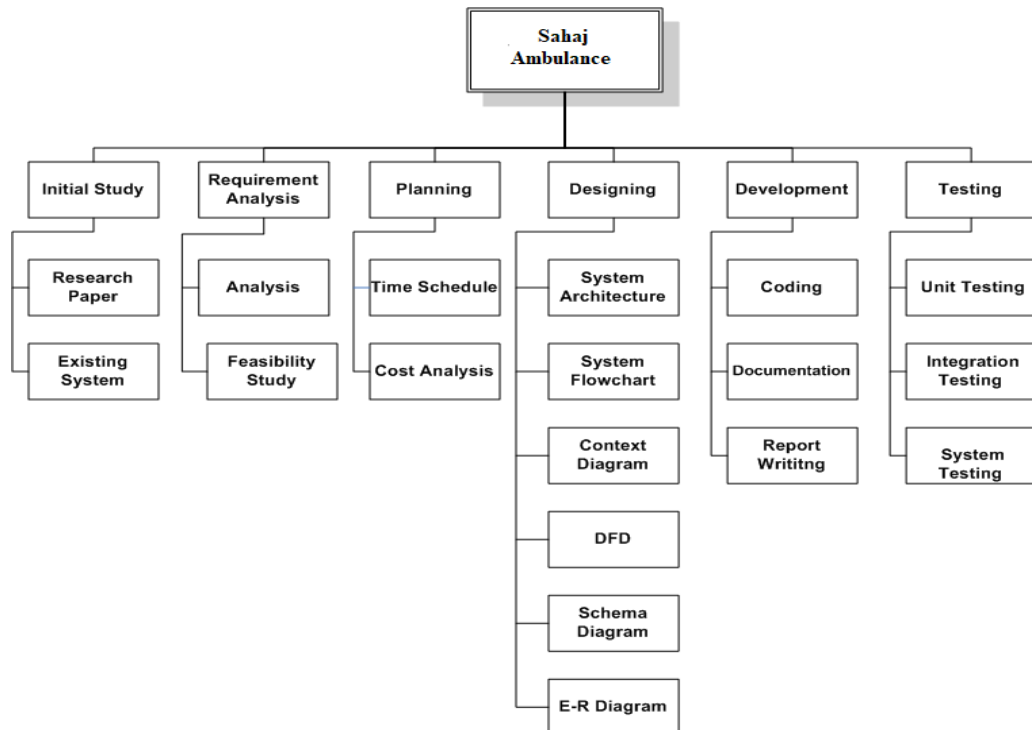


Figure 2: Work Breakdown Structure of Sahaj Ambulance

The diagram shown in Figure 2 shows the work breakdown structure of the project. This project “Sahaj Ambulance” has been broken down into six stages such as initial study, requirement analysis, planning, designing, development and testing. In the initial study, the existing system and research papers have been studied. Similarly, in the requirement analysis phase, the feasibility of the project has been studied and analyzed. During the planning phase, time schedule and cost analysis have been done. In the designing phase, system designs that define the components of the project have been made. The system design includes system architecture, system flowchart, context diagrams, data flow diagrams, schema diagrams as well as ER diagrams. Similarly, in the development phase, coding as well as documentation and report writing have been done simultaneously. All the testing like unit testing, integration testing and system testing takes place under the testing phase.

### **3.1.2 Development Model**

Development model, in general, is a conceptual framework used in making a diagnosis, understanding a developmental process and forming a prognosis for continued development [38]. For this project, incremental model suits the best as each new feature is added only after the completion of the previous features as well as the project has been decomposed into number of components and each component is built separately.

The incremental developmental model is software development model where the project model is designed, implemented and tested incrementally. It means a little more features are added each time until the product is finished. It involves development as well as maintenance. The product is declared to be completed only when it satisfies all of its requirements [39]. The product is decomposed into a number of components and each component is designed and built separately. This allows partial utilization of product and avoids a long development time. However, it needs good planning and designing as well as a clear and complete definition of the whole system before breaking it and building incrementally [40].

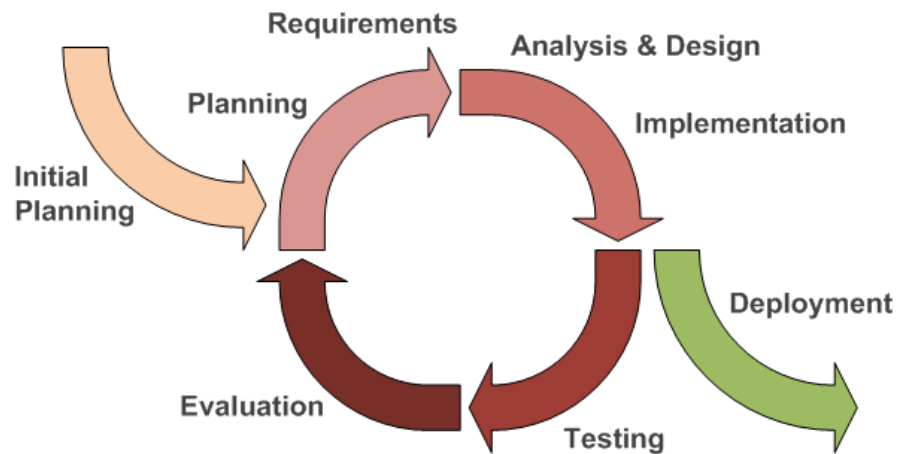


Figure 3: Incremental Model

The diagram in Figure 5 shows the incremental model of software development. In this model, a product is decomposed into several number of components. Each component is then designed and built separately. The main advantage of incremental model is that it is fast and flexible. Also, it is easier to test and debug during the smaller iteration.

### 3.1.3 System Development Tools

System development tools are the tools used for the completion of this project. Some of the tools are described as follows:

#### 3.1.3.1 Android Studio

Android Studio is the official IDE for Android development, and includes everything needed to develop Android apps in a single download. Android Studio provides the fastest tools for building apps on every type of Android device [32]. Based on IntelliJ IDEA, Android Studio provides the fastest possible turnaround on coding and running workflow. Android Studio's project structure and Gradle-based builds provide the flexibility you need to generate APKs for all device types. [33].

It has a rich UI development environment with templates to give new developers a launching pad into Android development [41]. Developers will find that Studio gives them the tools to build phone and tablet solutions as well as emerging technology



solutions for Android TV, Android Wear, Android Auto, Glass and additional contextual models.[42]

Android Studio has been used to develop this project as all the layouts have been defined in XML inside Android Studio. The programming done in Java for building the project has also been used as classes in the Android Studio.

### **3.1.3.2 Sublime Text**

Sublime Text is one of the most sophisticated text editor for coding and markup [43]. PC World has rated it 5/5 for its simplicity and sophistication at the same time. It is fast, feels lean on the surface with no toolbars and configuration dialogs and has same look across Linux, Windows and MacOS X [44]. It fills the gap between the basic text applications like Notepad, TextEdit, gedit, etc and has full Integrated Development Environments (IDE) like the ones provided by Visual Studio, Eclipse, NetBeans, etc. It is very well suited to web development and highly customizable with cross-platform plugins and themes [45].

For building this project, Sublime Text has been used to write the PHP scripts and SQL queries to connect and query the database.

### **3.1.3.3 Java**

Java is a programming language and computing platform first released by Sun Microsystems in 1995. Java is fast, secure, and reliable. From laptops to datacenters, game consoles to scientific supercomputers, cell phones to the Internet, Java is everywhere [46]. The Java programming language was developed by a small team of engineers, known as the Green Team, who initiated the language in 1991 [47].

All the business logic of this project has been written in Java which defines the functionality of the project. Features of Java such as interface, inheritance, event handler have been widely used in this project.

#### **3.1.3.4 PHP**

PHP (recursive acronym for PHP: Hypertext Preprocessor) is a widely-used open source general-purpose scripting language that is especially suited for web development and can be embedded into HTML [48]. Instead of lots of commands to output HTML PHP pages contain HTML with embedded code that does something.

For building this project, PHP has been used to carry out all the server-side scripting ranging from database connection to performing all the database queries and retrievals.

#### **3.1.3.5 XML**

Extensible Markup Language (XML) is used to describe data. The XML standard is a flexible way to create information formats and electronically share structured data via the public Internet, as well as via corporate networks. XML code, a formal recommendation from the World Wide Web Consortium (W3C), is similar to Hypertext Markup Language (HTML). XML data is known as self-describing or self-defining [49].

XML has been used in this project to design and build all the layouts in the mobile application. All the user interfaces have been developed in the XML format.

#### **3.1.3.7 MySQLi**

The MySQLi Extension (MySQL Improved) is a relational database driver used in the PHP scripting language to provide an interface with MySQL databases. PHP's MySQL-related extensions, such as the MySQLi extension, and the MySQL extension, are implemented using the PHP extension framework. An extension typically exposes an API to the PHP developer, to allow its facilities to be used programmatically. [50].

MySQLi has been used in building this project to write the queries for database operations which have used with PHP.

### **3.2 System Analysis**

Systems analysis is the methodical evaluation of an activity to identify its desired objectives and determine procedures for efficiently attaining them. It includes the investigation of a problem and the identification and ranking of alternative solutions to the problem, typically by mathematical means in order to discover operations and procedures for accomplishing them most efficiently

The four important phases of system analysis are study phase, design phase, development phase and implementation phase [51]. The structural process of system analysis provides a good analysis that is essential for the development of a new improved system.

This project is based on mobile technology with the primary requirement of internet and GPS. Hence, it has used the tools required to develop an interactive system for use during emergencies. Basically, as the user requests for the ambulance, his/her contact details, name and contact number provided during registration is sent to the ambulance service provider with his/her current location. As soon as the service provider starts the service, the service requester will then be able to track the ambulance while it is on its way. During emergencies, some basic home-based techniques can also help the patient and control the situation from worsening, thus while the ambulance is on its way to pick up the patient, the immediate health tips can be utilized to take the home-based steps to assist the patient and control the situation up to the best possible level.

### **3.3 System Design**

System design is basically a process of defining the components, modules, interfaces and data for a system in order to satisfy specified requirements. It can also be defined as a process of creating or altering systems along with the processes, practices, models and methodologies that can be used to develop them [52]. System design involves identifying data sources, the nature and type of data and their availability. It also ensures that the system is created in a way that fulfills the need of the users. The other

importance of system design is that it is intended to design such a system which can be dynamic in nature and responsive to the changes if required [53].

The main objective of the detailed system design is to prepare a blueprint of a system that meets the goals of the conceptual system design requirements [54]. Detailed system design generally involves the following phases: project planning and control, involve the user, define the detailed sub-system, input/output design, feedback form the user, database design, procedure design and design documentation [55].

The system design used for building this project include system architecture, system flowchart, context diagram, DFD (Data Flow Diagram), use case diagram, sequence diagram, activity diagram, schema diagram, ER (Entity Relationship) diagram. The diagrams are shown and represented in further below.

### **3.3.1 System Architecture**

The diagram in Figure 4 shows the overall system architecture of Sahaj Ambulance. The user using his/her smartphone requests for the ambulance service which is first stored in the database, after that the driver or the ambulance service provider is notified about the request. Following the request notification, the service provider is to confirm if they are providing the service. Once the service provider starts the ride, the user is sent notification about it. The location of the ambulance is tracked and following the server and the central database, the user gets information about the ambulance location. The service stops once the ambulance picks up the patient and stops the location sharing.

## System Architecture

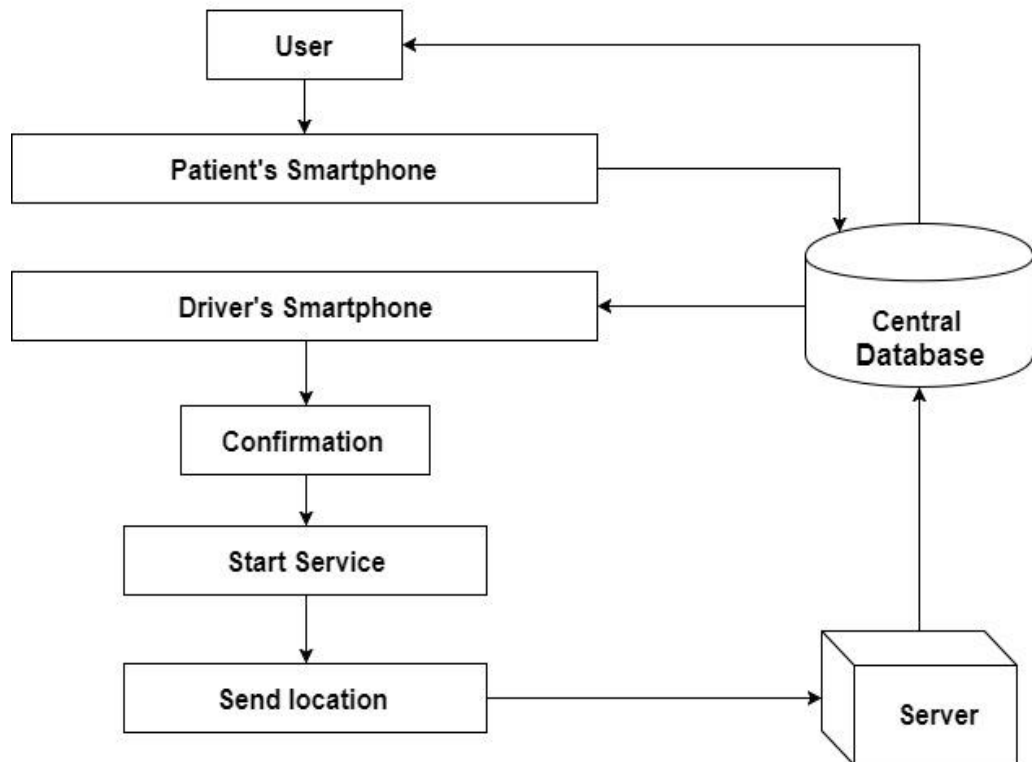


Figure 4: System Architecture of Sahaj Ambulance

### 3.3.2 System Flowchart

The diagram in figure 5 shows the system flowchart of Sahaj Ambulance. The first requirement for using the application is the user login. The logged in user are redirected to the home screen whereas the users not logged in must login themselves first.

Then, the user can perform any of the available three operations. For requesting the ambulance, the user calls any of the available ambulance and then after the request confirmation, the driver shares his location with the patient which the user can track through the application only. For the other two options, i.e. ambulance directory and the immediate help, the application fetches data from the database of the application.

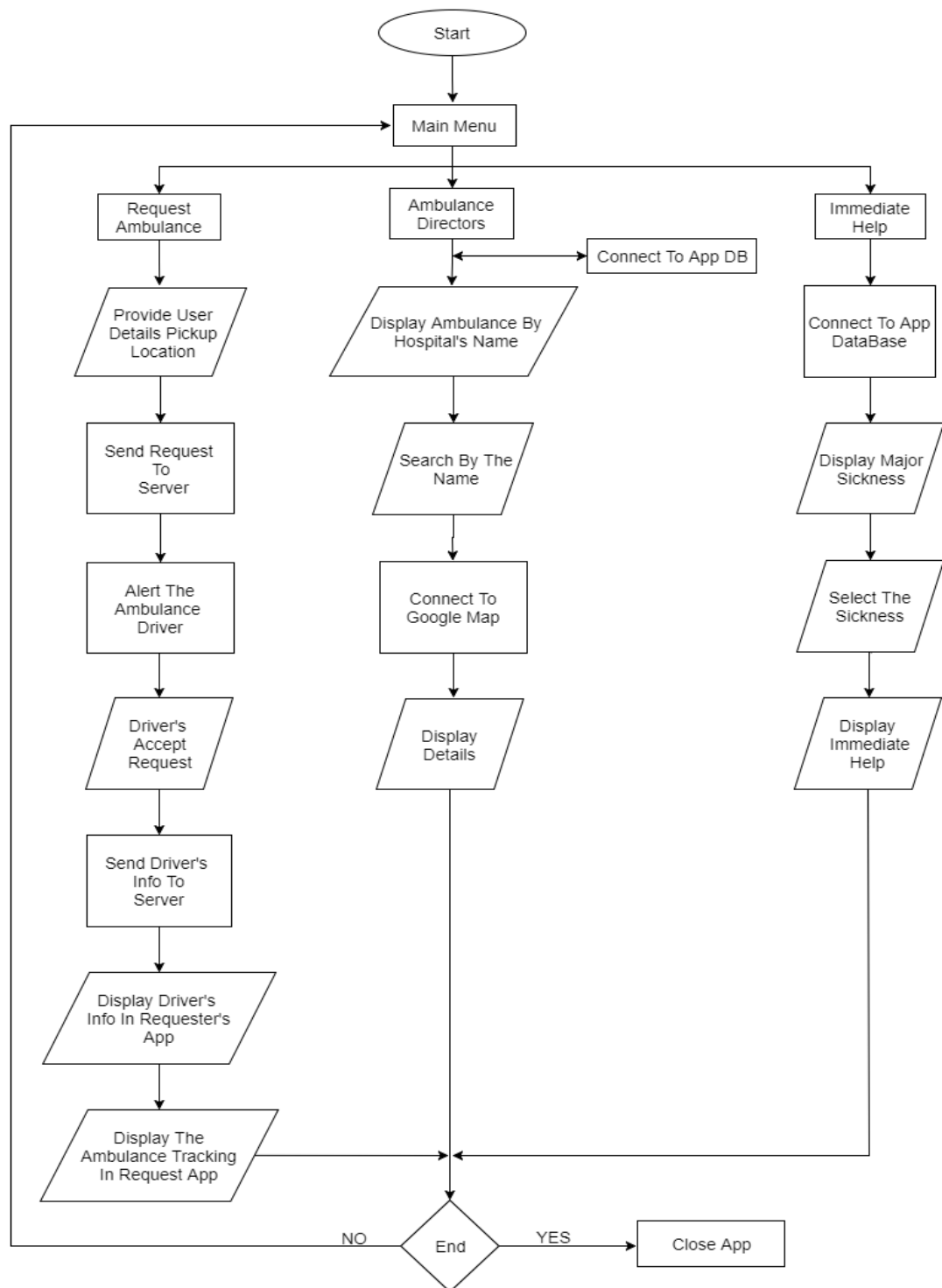


Figure 5: System flowchart of Sahaj Ambulance

### 3.3.3 Context Diagram

A Context diagram basically represents a high-level view of the overall system. It defines the system's domain that is under investigation within an environment. It depicts the top process together with its major incoming and outgoing data flows linked to participating external entities [56]. It identifies the external entities along with major data interfaces that interact with the target processes. It can therefore be a very useful tool for helping identify the project scope [57].

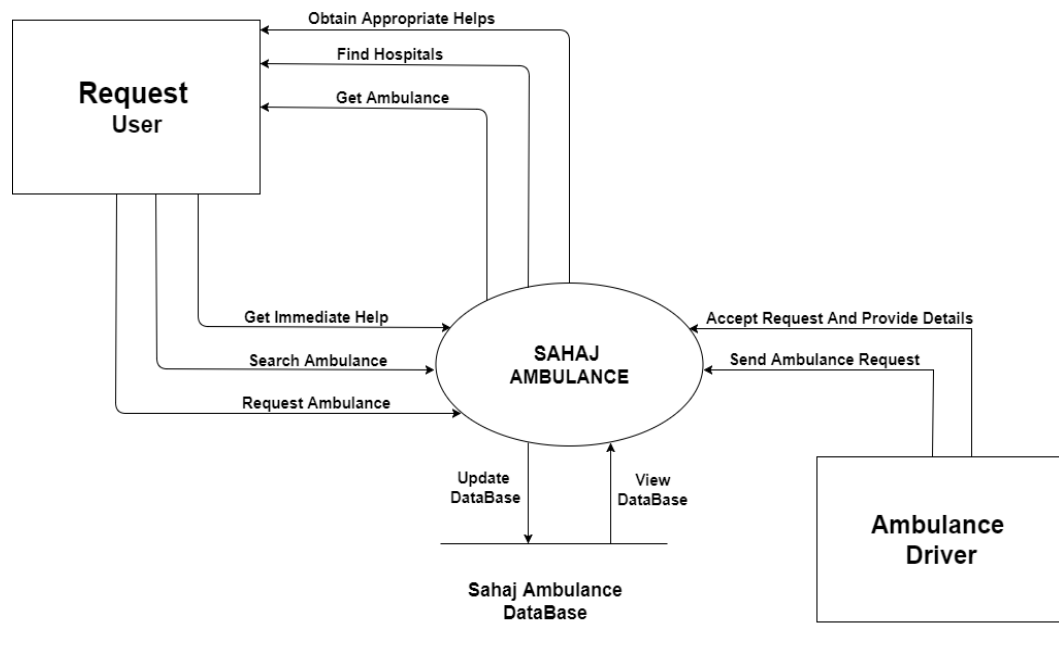


Figure 6: Context Diagram for Sahaj Ambulance

The diagram above, figure 6 shows the context diagram of the project Sahaj Ambulance. Sahaj Ambulance consists of two primary entities who are involved in its working.

User has the privileges of three major services, the most important one being requesting an ambulance for service during emergencies. The user can request for ambulance by

sharing the personal details, name and contact number provided during registration and then his/her current location. The other available operations for user are to search or get information about the ambulance service in Kathmandu valley and the other available operation is to get immediate treatment helps which will be completely home-based.

The other entity, the ambulance driver or ambulance service provider has one operation to be done which is to accept or reject the ambulance service. Once the user requests for the service, the ambulance service provider are notified about it. If they accept the request, their location will be shared with the user thus the user will be able to track the ambulance throughout its journey. Once the ambulance has reached the address of the patient, the service providers can then stop sharing location or if anyone related to the patient who cannot go with him/her asks to keep his location sharing throughout the way back to the hospital, the ambulance service provider can do so as well. Once they reach the hospital and the ambulance service provider will get the information through tracking and thus the ambulance service provider can then stop sharing the location.

### **3.3.4 Data Flow Diagram Level 1**

A Data Flow Diagram (DFD) is a diagram that illustrates how data is processed by a system in terms of inputs and outputs. As its name suggests, its focus is on the flow of information, where data comes from, where it goes and how it gets stored [58]. There are only four symbols used in a DFD: squares, circles, arrows and open ended rectangles. The squares represent external entities which are sources or destinations of data. Each circle represents a process, which takes data as input, processes it and gives the output. The arrows represent the data flows, which can either be electronic data or physical items. Finally, open-ended rectangles represent the data stores, including electronic stores such as databases or eXtensible Markup Language (XML) files and physical stores such as filing cabinets or stacks of paper [59].



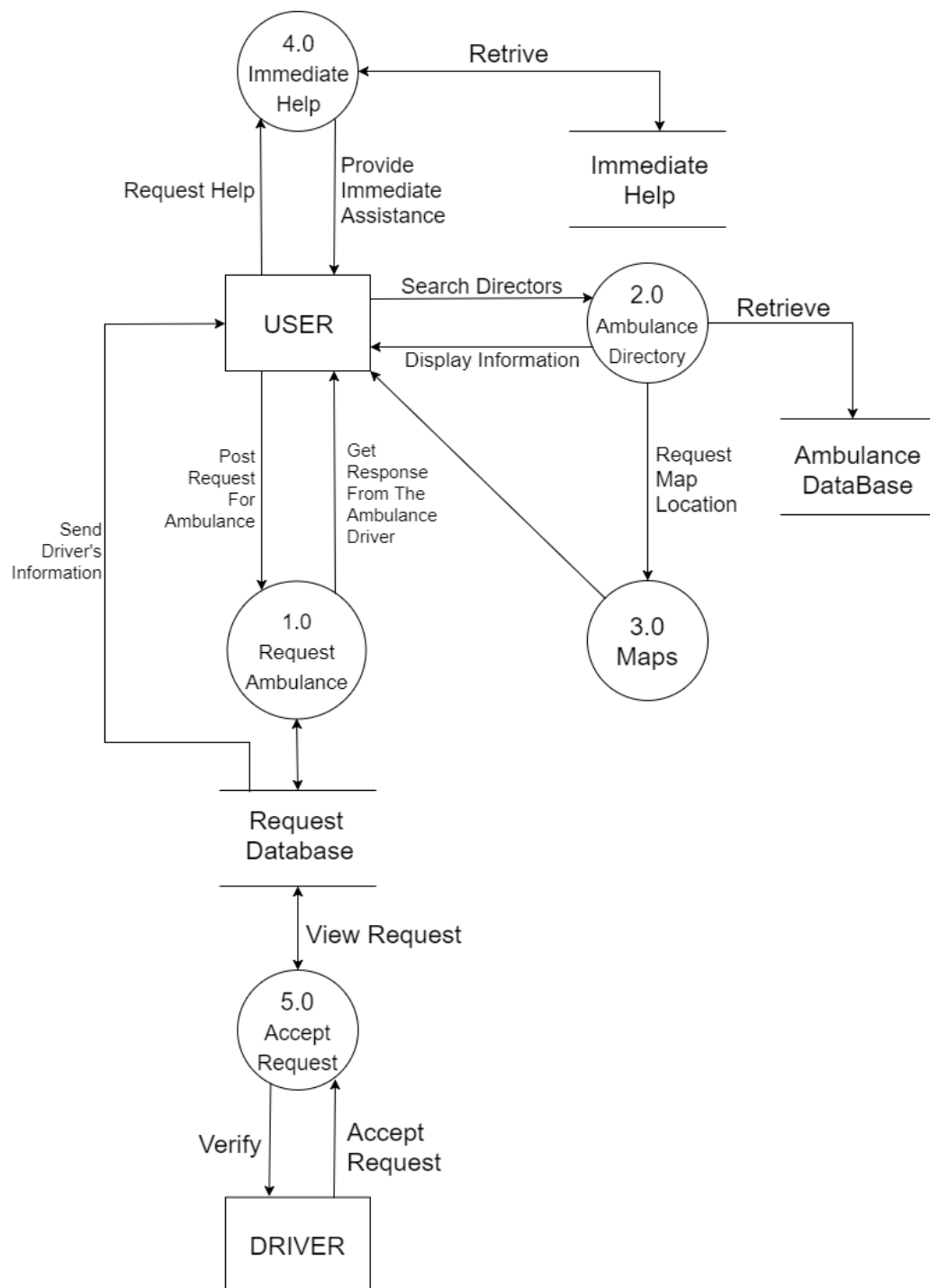


Figure 7: DFD Level 1 of Sahaj Ambulance

This project has five major processes which have been represented as individual processes in the Data Flow Diagram. The five major processes are as follows:

- Requesting ambulance for service
- Ambulance Directory
- Immediate help in case of emergency
- Maps Operation for the location sharing and locating the ambulance service providers
- Accepting requesting of ambulance service by the ambulance service provider, in most of the cases, the ambulance driver

All of these processes have been further decomposed individually to provide a clear view about all of these processes take place and what sub-processes are involved in these process.

The diagram below in the figure 7 represents how the operation starts in this project and the data flow sequence from one process to another to get the work done in the application.

### 3.3.5 Data Flow Diagram Level 2

#### 3.3.5.1 Decomposing Process 1

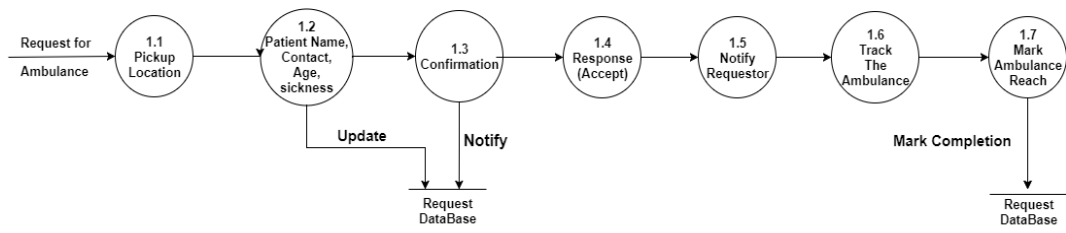


Figure 8: DFD Level 2 for Process 1

The diagram in Figure 8 is the decomposition of process 1 of DFD level 1 shown in Figure 7. In this diagram, the user first selects the pickup location which will be the current location of the user, then the patient's detail will be sent to the ambulance service provider. After the request has been placed, the service provider will be notified about it and once the service provider accepts the request, the user will be notified about it and then will be able to track the ambulance on its way to pick up the patient. Once

the ambulance reaches the patient's location, the operation is said to be complete. The ambulance can be further tracked on its way back to hospital as well for patient's family conformity. The tracking service will be stopped only when the ambulance service provider stops the service.

### 3.3.5.2 Decomposing Process 2

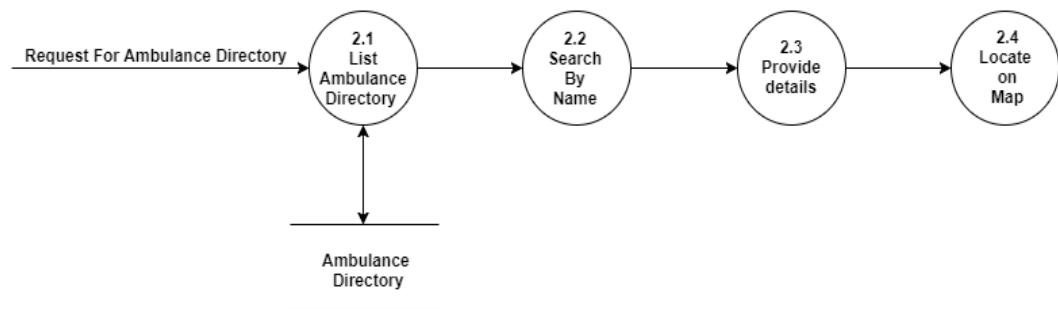


Figure 9: DFD Level 2 for Process 2

The diagram in figure 9 is the decomposition of process 2 of DFD level 1 shown in figure 7. Here the operation of ambulance directory has been shown. First of all, the user can access a list of ambulance from the directory. Then the user can search as per his needs and then get the details about it. Furthermore, to know the location the user can use the location service to find the ambulance service provider's location.

### 3.3.5.3 Decomposing Process 3

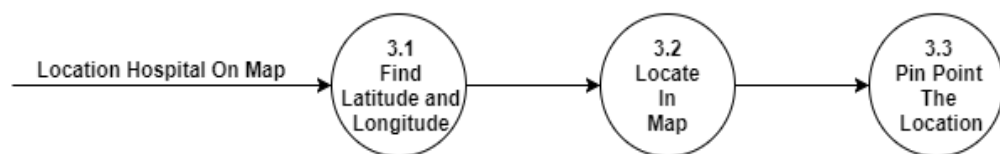


Figure 10: DFD Level 2 for Process 3

The diagram in figure 10 is the decomposition of process 3 of DFD level 1 shown in figure 7. The decomposition shows how the operation of locating on map is performed. At first, the latitude and longitude of the requested ambulance service provider is found out and then it is located on the map with a pin point.

#### 3.3.5.4 Decomposing Process 4

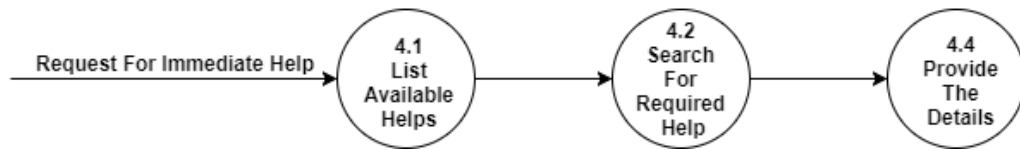


Figure 11: DFD Level 2 for Process 4

The diagram in the figure 11 is the decomposition of process 4 of DFD level 1 shown in figure 7. The operation of immediate home-based treatment helps has been decomposed here. The user first gets a list of possible helps for various types of sickness and emergency condition. The user can search help for the needed one and carry out the proceedings accordingly.

#### 3.3.5.5 Decomposing Process 5

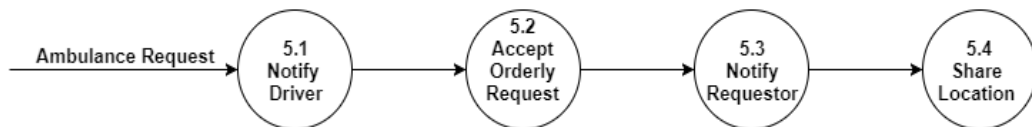


Figure 12: DFD Level 2 for Process 5

The diagram in the figure 12 is the decomposition of process 5 of DFD level 1 shown in figure 7. This decomposition shows how the ambulance service provider perform their operation. As soon as any user requests an ambulance for service, the service provider is notified about the request with the user's name, contact number and location. Then, the driver accepts the request if available. As soon as the driver accepts the request, the user is notified about it and then the ambulance service provider starts sharing the location thus the user will be able track the ambulance on its way to pick up the patient. The location will be shared by the ambulance service provider until it reaches the patient's address. Furthermore, the service provider can keep on sharing the location on its way back if the patient's family or closed one requests for the service.

### 3.3.6 Use Case Diagram

A use case diagram is a simple written description of how users will perform tasks on a system. It shows the system from a user's point of view and the system's behavior as it responds to a request [60]. It is basically a type of textual requirements specification that captures how a user will interact with a system to achieve a specific goal. The use case diagram usually contains an actor, basic flow, post conditions and processes [61].

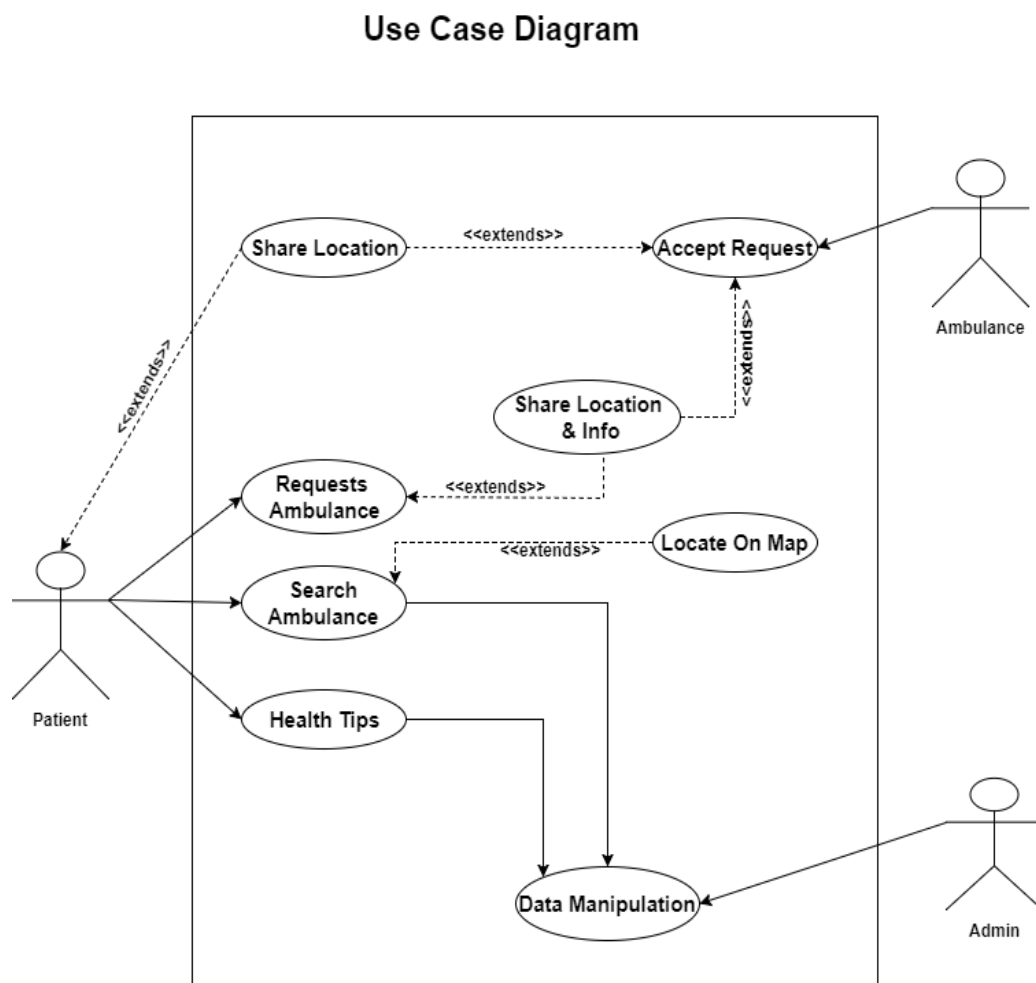


Figure 13: Use Case Diagram of Sahaj Ambulance

The diagram in figure 13 shows the use case diagram of Sahaj Ambulance. There are three actors; patient, ambulance service provider and the admin. The patient or the user includes three operations; request ambulance, search ambulance and get immediate health tips. The option of requesting an ambulance extends to sharing the name, contact

number and the location. The ambulance directory option extends to locate on map but this is on request.

The ambulance service provider has one option which is to accept request. Once the ambulance service provider accepts the request, the option extends to sharing the location of the ambulance so as the patient or the user can track the ambulance on its way.

The admin is responsible for all the user and ambulance registration and carrying out all the related operations such as maintain the ambulance registry, immediate health tips so that all the operation can be performed effectively and efficiently in the application.

### **3.3.7 Sequence Diagram**

Sequence diagrams represent the flow of logic within the system in a visual manner, which enables both to document and validating the logic. It is used for both analysis and design purposes. One of the important characteristics of a sequence diagram is that the time passes from top to bottom i.e. the interaction starts near the top of the diagram and ends at the bottom [62].

The sequence diagram for two major operations of the project, requesting an ambulance and accepting ambulance request have been explained below:

#### **3.3.7.1 Sequence Diagram for Requesting Ambulance**

The operations that are followed in an order to place a request for ambulance consist of enabling the location sharing on the user's phone then selecting the menu of request ambulance form where the user places a request for ambulance. This record is then sent in the database for record. The request is then passed on the server from where the ambulance service provider is made aware of the request.

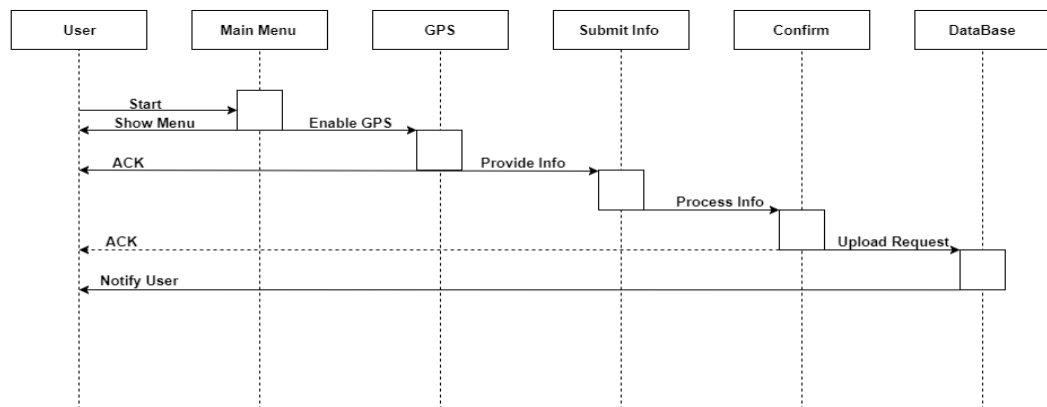


Figure 14: Sequence Diagram for Requesting Ambulance

The diagram in figure 14 shows the sequential operations for requesting an ambulance using the Sahaj Ambulance application.

### 3.3.7.2 Sequence Diagram for Accepting Ambulance Request

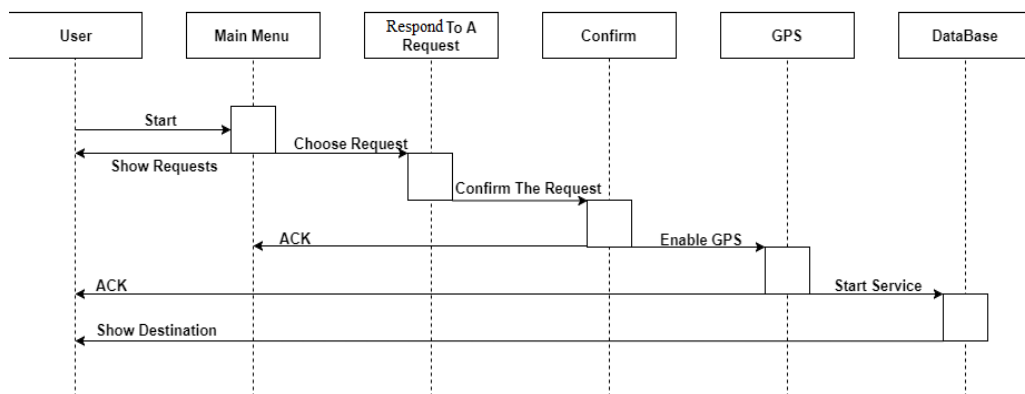


Figure 15: Sequence Diagram for Accepting Ambulance Request

The sequence diagram for accepting an ambulance request by the ambulance service provider has been shown in figure 15. In the operation of accepting the request, the ambulance service provider is first notified about the new request. Then the service providers are to respond to the request and give confirmation. After the confirmation, the service provider starts sharing the location through the GPS and all the location history of the ambulance service provider are then regularly updated in the database. The storing of location is brought to an end once the ambulance reaches the user's location.

### 3.3.8 Schema Diagram

A database schema can be defined as the skeleton structure that represents the logical view of the entire database. It basically defines how the data is organized and how the relations with each other are associated. It also formulates all the constraints that are to be applied on the data. A database schema defines all of its entities and the relationship among them. It contains a descriptive detail of the database, which helps the programmers understand the database and make it useful [63].

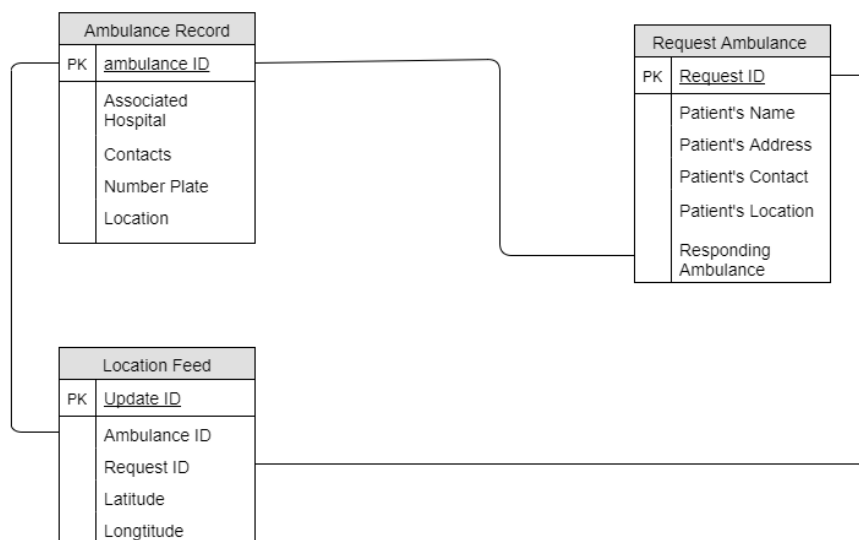


Figure 16: Schema Diagram of Sahaj Ambulance

The above diagram in Figure 29 represents the database table schema of the project that shows the database table and their relationships. The database is comprised of following tables:

**Ambulance Record:** This table consists of all the related details of ambulances in the application. Every ambulance is assigned an unique ID, which will be called as ambulance ID. These details will be available for the user from the ambulance directory of the application.

**Location Feed:** This table is used to keep track of the ambulance while it is on its way to pick up the patient. Every update will be kept unique by assigning a unique ID to



every update following the request. The user will track the ambulance following the records of this table.

**Request Ambulance:** This table is used to keep track of the records placed by the users for the ambulance service. Every request will be identified by its unique request ID. The table will contain details about the service requester and the provider following the unique ID for the ride.

**User Details:** This table as per its name will have record of the user. The table will be updated every time a new user register him/herself. The registration will require details such as the username, e-mail address, contact number and password. The login will also be carried out following the rows of every registered user using this table.

### **3.3.9 Entity Relationship Diagram**

An entity relationship (ER) diagram basically shows the relationships of entity sets stored in a database. An entity can be understood as a component of data. In general, ER diagrams illustrate the logical structure of databases. It is a means of visualizing how the information produced by a system is related. There are five main components of an ER diagram. The entities are represented by rectangles. Actions are represented by diamond shapes, which show how two entities share information in the database. The attributes of the entity are represented by ovals. The connecting connects attributes to show the relationships of entities in the diagram. The cardinality finally specifies how many instances of an entity relate to one instance of another entity [64].

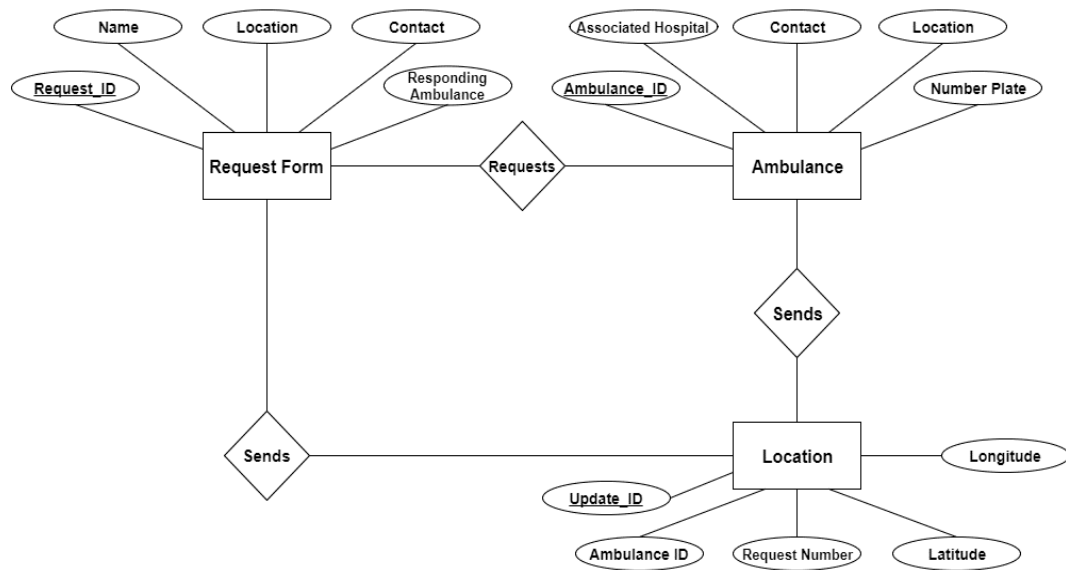


Figure 17: ER Diagram for Sahaj Ambulance

The diagram above in Figure 17 is an abstract representation of the entities and their relationship of the database used in the project. The rectangular box represents the entity, ellipse represents the attributes and the diamond represents the relationships. The entities in the above figure are explained below:

i. Ambulance

Attributes: Ambulance\_ID, Associated\_Hospital, Contact, Location, Number Plate

Primary Key: Ambulance\_ID

Relationship with: Location, Request Form

ii. Location

Attributes: Update\_ID, Ambulance\_ID, Request\_ID, Latitude, Longitude

Primary Key: Update\_ID

Foreign Key: Ambulance\_ID, Request\_ID

Relationship with: Ambulance, Request Form

### iii. Request Form

Attributes: Request\_ID, Name, Location, Contact, Responding Ambulance

Primary Key: Request\_ID

Relationship with: Ambulance, Location

## 3.4 Project Schedule

The project schedule is basically a tool that communicates what work needs to be performed, which resources will perform the particular work and the timeframes in which that work needs to be performed. It reflects all of the work associated with delivering the project on time [65].

### 3.4.1 GANTT Chart

A Gantt chart, commonly used in project management, is one of the most popular and useful ways of showing activities (tasks or events) displayed against time. On the left of the chart is a list of the activities and along the top is a suitable time scale. Each activity is represented by a bar; the position and length of the bar reflects the start date, duration and end date of the activity.

A Gantt chart helps to visualize the following any project related parameters at a glance:

- What the various activities are
- When each activity begins and ends
- How long each activity is scheduled to last
- Where activities overlap with other activities, and by how much
- The start and end date of the whole project [66]

The Gantt chart of this project is represented in the figure below which shows all the activities that we carried out for this project and the time scale and the overall time schedule. The Gantt chart helps to visualize the overall processes involved in Sahaj Ambulance at once.



### 3.4.2 Time Schedule

The detailed time schedule of this project is explained below:

Task ID	Task Description	Start Date	Finished Date
<b>1</b>	<b>Preliminary Work</b>		
1.1	Planning for the project	02/22/17	02/26/17
1.2	Analysis on the topics	02/27/17	03/03/17
1.3	Discussion with the Supervisor	03/04/17	03/07/17
1.4	Background reading	03/07/17	03/17/17
1.5	Preparation of project proposal	03/18/17	03/23/17
1.6	Preparing the Gantt Chart and Project Schedule	03/23/17	07/30/17
1.7	Approval from Supervisor	03/27/17	03/31/17
<b>2</b>	<b>Research Work</b>		
2.1	Research on Ambulance usage	04/01/17	04/04/17
2.2	Research on GPS technology	04/05/17	04/09/17
2.3	Research on Android	04/10/17	04/14/17
2.4	Research on GPS model for android	04/15/17	04/19/17
2.7	Research to prepare Best Design	04/20/17	04/24/17
<b>3</b>	<b>Design</b>		
<b>3.1</b>	<b>Application Design</b>		
3.1.1	Data Flow Diagram	04/25/17	04/31/17
3.1.2	Use Case Diagram	05/01/17	05/07/17
3.1.3	Flow Chart Diagram	05/08/17	05/12/17
3.1.4	Design User Interfaces	05/13/17	05/17/17
<b>3.2</b>	<b>Database Design</b>		
3.2.1	ER-Diagram	05/18/17	05/20/17
3.2.2	Schema Diagram	05/21/17	05/23/17
<b>4</b>	<b>Implementation</b>		
4.1	Database Design	05/24/17	05/30/17
4.2	Program coding	05/31/17	07/04/17
<b>5</b>	<b>Testing</b>		
5.1	Unit Testing	07/05/17	07/09/17
5.2	System Testing	07/10/17	07/14/17
5.3	Alpha Testing	07/15/17	07/18/17
5.4	Validation Testing	07/18/17	07/20/17
<b>6</b>	<b>Dissertation</b>		
6.1	Draft Report Writing	07/20/17	07/25/17
6.2	Final Report Writing	07/26/17	07/31/17
6.3	Report Evaluation and Conclusion	08/01/17	08/01/17
6.4	Submission of Final draft copy Report	08/02/17	08/02/17
6.5	Corrections for Final draft copy Report	08/03/17	08/03/17
<b>7</b>	<b>Final Phase</b>		
7.1	Final Documentation Printing and Binding	08/03/17	08/03/17
7.2	Document Submission to College	08/04/17	08/04/17

Figure 19: Time Schedule

### **3.5 Testing**

Testing is evaluation of the software against requirements gathered from users and system specifications. Software system testing identifies important defects, flaws, or errors in the application code that must be fixed. Testing is conducted at the phase level in software development life cycle or at module level in program code. Software testing comprises of Validation and Verification [67].

The testing performed in this project are mentioned below:

#### **3.5.1 Unit Testing**

Unit testing refers to the testing certain functions and areas of the code. It gives the ability to verify that all the functions work as expected. Eventually, it helps to identify failures in the algorithms as well as logic to help improve the quality of the code that composes a certain function [68].

Unit testing has been performed for every function in this project during its development phase.

#### **3.5.2 Integration Testing**

Integration testing is basically a logical extension of unit testing. In simple words, two tested units are combined into a component and the interface between them is tested. It identifies problems that occur when different units are combined [69].

The different modules of this project have undergone integration testing while being merged.

#### **3.5.3 System Testing**

System testing tests the behavior of whole system as defined by the scope of the development project. It might include tests based on risks as well as requirement specifications, business process, use cases or other high level descriptions of system

behavior, interactions with the operating systems and system resources. It is most often the final test performed to verify that the system meets the specification and its objectives [70].

System testing has been performed at the completion of each feature and is still taking place to make improvements on the existing system. The system testing cases that have been done have been listed below along with the test output image:

### 3.5.3.1 Test Case 1

Test Objective: Test for Splash Screen

Test Performed: 5.00-inch touchscreen display with a resolution of 720 pixels by 1280 pixels

Output: Test is successful with the splash screen being displayed.

Conclusion: Splash screen appears when the app is loaded.



Figure 20: Testing of Splash Screen

### 3.5.3.2 Test Case 2

Test Objective: Test for Valid Registration

Test Data:

Valid Credentials: Username: Linus | Contact No.: 9843123456 |

E- mail address: linusd@hotmail.com | Password: linus123

Invalid Credentials Case 1: Username: | Contact No.: 98034444444 |

E-mail address:pds@gmail.com | Password: pranesh1

Invalid Credentials Case 2: Username: Jeyy karki | Contact No.: 9841567895 |

E-mail: jeyy@gmail | Password: password

Output:

Valid Credentials: Android toast of Registration Successful

Invalid Credentials Case 1: Android toast of Please Enter Valid Username

Invalid Credentials Case 2: Android toast of Please Enter Valid Email

Conclusion: A new account can only be registered after providing all the required credentials in its correct form.

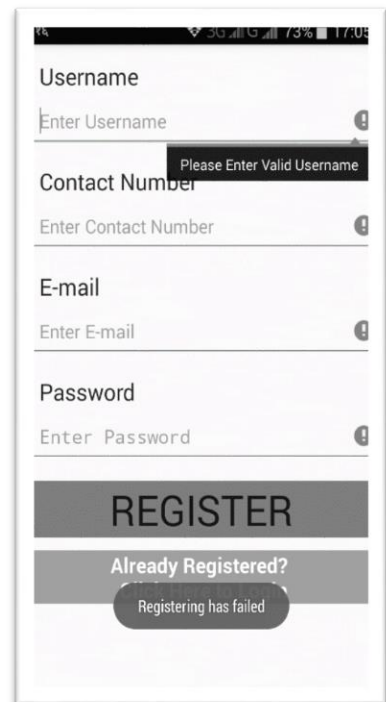


Figure 21: Test of Valid Registration

### 3.5.3.3 Test Case 3

Test Objective: Test for Valid Login

Test Data: Valid username: Linus Dhakal | password: linus123

Invalid username: Linus | password: password

Output: Valid: Home screen Loaded

Invalid: Generated toast of Invalid Username or Password and stayed in the login screen only

Conclusion: Application can be accessed only with valid username and password

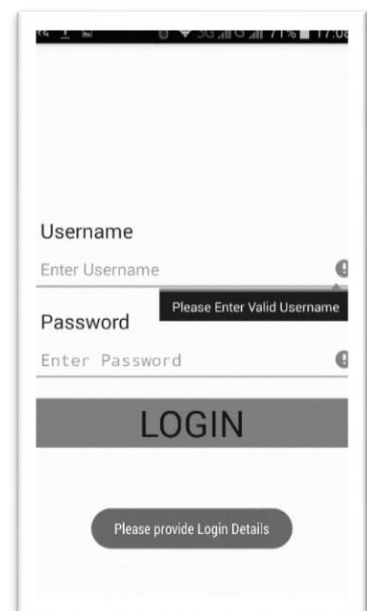


Figure 22: Test of Valid Login



#### 3.5.3.4 Test Case 4

Test Objective: Test for Ambulance Request

Test Performed: Ambulance was requested from Buddhanagar.

Output: Request was placed.

Conclusion: Ambulance can be requested from the current location.



Figure 23: Test of Ambulance Request

#### 3.5.3.5 Test Case 5

Test Objective: Test for tracking of ambulance

Test Performed: The request was made from Buddhanagar to ambulance in Thapathali.

Output: The ambulance was tracked throughout its ride.

Conclusion: Ambulance on its way as response to the request can be tracked throughout its journey.

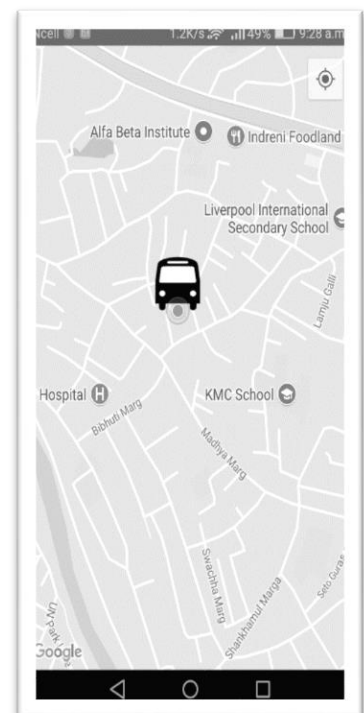


Figure 24: Test of tracking ambulance

### 3.5.3.6 Test Case 6

Test Case: Test for functioning of ambulance directory

Test Performed: An operation was carried out to locate an ambulance service provider in map from the directory.

Output: The ambulance service provider was located in the map.

Conclusion: The user can contact or get information about the service providers using the application.

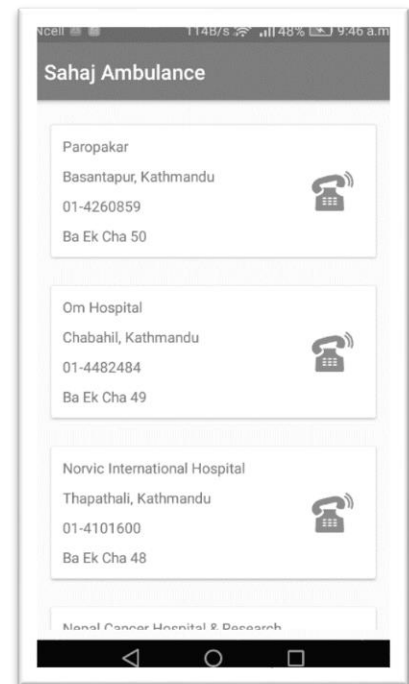


Figure 25: Testing of Ambulance Directory

### 3.5.3.7 Test Case 7

Test Case: Test for functioning of immediate help

Test Performed: Immediate home-based treatment for snake bite was searched.

Output: List of home based activities to control the spread of snake bite effects were displayed.

Conclusion: The user can get home based treatment help from the app.

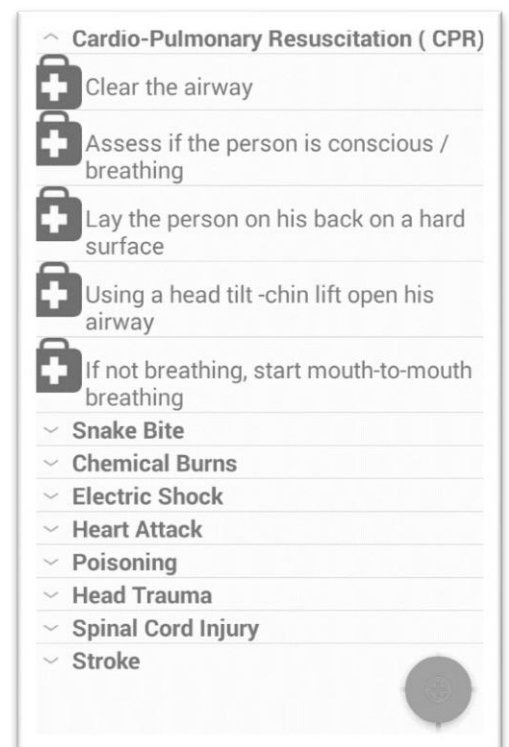


Figure 26: Test of Immediate Help

### **3.6 Implementation Method**

System implementation specifies how the system is installed, operated and maintained. It also ensures that the system meets the quality standards. System implementation is the test program that exercises the complete system in its actual environment to determine its capabilities and limitations which also demonstrates that the system is functionally operative, and is compatible with the other subsystems and supporting elements required for its operational deployment [70].

The screens were designed in XML and the business logic was written in Java. The database used is MySQLi where all the information related to user's registration details and current location. The web service used to connect MySQL database with Android is PHP. The PHP files are located on the XAMPP Server. The web services have been hosted in the free webhost service provided by 000webhost.com. Google Maps API has been used to make it easy for the user to track the ambulance while performing its operation.

From the user aspect, the project can be implemented just by installing the app in their android phones and allowing permission of GPS. The application can be easily run over the internet. The project is practical and cost efficient due to which any general people can use it. The minimum Android version required for this application is 4.1, so people using the older versions of Android can also easily use the app and be benefitted by its services.

This project is an initiation to bring the changes in how we have using the ambulance service. While everything in the world is getting digitized and taken over by technology, the project will also help general people to grow their technical skills and use the free gift of technology in their da-to-day life. The project can be implemented by the governmental level health-related departments as well to provide the technological gift to people wherever possible.

### **3.7 Support and Maintenance**

Support and maintenance is an ongoing process throughout the project operation. The support and maintenance for this project shall be continued with improving features of the project. New progress and features that will make the project more functional, practical and user-friendly should be added. Similar progress and features should be added to the server as well, with the establishment of dedicated servers and increasing the project operational area to a larger geographical area and make the project accessible to all users wherever the project is feasible.

## CHAPTER 4: RESULT ANALYSIS

### 4.1 Screenshots

The final result of this project was the development of an Sahaj Ambulance. Although it is a single project development of two applications was necessary, one application for the user and the other for the ambulance service provider or the ambulance driver. For the operation to take place, the user or the requester uses the Sahaj Ambulance application whereas the driver uses the Sahaj Driver application. The request is made using Sahaj Ambulance and the response is given using Sahaj Driver. Both the application should be working stage and should provide required privileges in the mobile for the operation.

The screenshots of the main pages of the system are placed and explained below.

#### 4.1.1 Splash Screen

Functional Prototype:

```
public void run() {  
    try {  
        sleep(1500);  
        Intent intent = new  
Intent(getApplicationContext(),registerUser.class);  
        startActivity(intent);  
        finish();  
    } catch (InterruptedException e) {  
        e.printStackTrace();  
    }  
}
```

The image in the figure 28 shows the splash screen of the Sahaj Ambulance. It is the first screen that is loaded when the application is opened. This screen remains for 1.5 seconds and redirects to home screen if the user is logged in else it redirects to the registration page where the unregistered user registers him/herself and following the screen the logged out user logs in into the application.



Figure 27: Splash Screen of Sahaj Ambulance

#### 4.1.2 Registration Screen

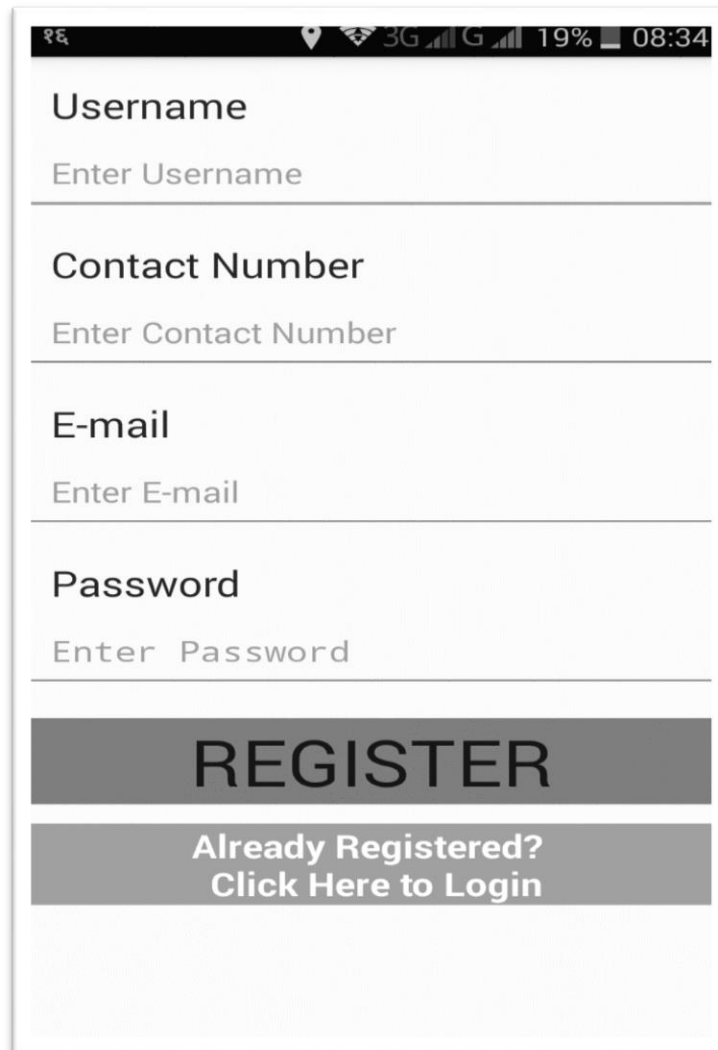
##### Function Prototype

```
private void registerUser() {
    progressDialog.setMessage("Registering User");
    progressDialog.show();
    StringRequest stringRequest = new StringRequest(Request.Method.POST,
        Constants.URL_Register,
        new Response.Listener<String>() {
            @Override
            public void onResponse(String response) {
                progressDialog.dismiss();
                try {
                    JSONObject jsonObject = new JSONObject(response);
                    Toast.makeText(getApplicationContext(),
                        jsonObject.getString("message"), Toast.LENGTH_LONG).show();
                } catch (JSONException e) {
                    e.printStackTrace();
                }
            }
        },
        new Response.ErrorListener() {
```

```

@Override
public void onErrorResponse(VolleyError error) {
    progressDialog.dismiss();
    Toast.makeText(getApplicationContext(),
error.getMessage(), Toast.LENGTH_LONG).show();
}
})

```



The image shows a mobile application registration screen. At the top, there is a status bar with icons for signal, Wi-Fi, and battery, along with the time 08:34. The screen contains four input fields, each with a label and a placeholder text: 'Username' (placeholder: 'Enter Username'), 'Contact Number' (placeholder: 'Enter Contact Number'), 'E-mail' (placeholder: 'Enter E-mail'), and 'Password' (placeholder: 'Enter Password'). Below these fields is a large, dark gray button labeled 'REGISTER'. Underneath the button is a link that says 'Already Registered? Click Here to Login'. At the bottom of the screen, there is a faint, light gray text that reads 'Sahaj Ambulance'.

Figure 28: Registration Screen of Sahaj Ambulance

The image in the figure 29 shows the registration screen for users of Sahaj Ambulance. Various validation techniques have been implemented for the registration process such as none of the fields can be empty or giving wrong format e-mail address or even not giving the correct length of the mobile number. The checking of mobile number has been set as per the convention of the ten-digit. After providing all the correct

information can only a user register his/her account. The already registered but logged out users can login from the button in this screen which will redirect to the login screen.

### 4.1.3 Login Screen

Function Prototype:

```
private void userLogin() {
    StringRequest stringRequest = new StringRequest(
        Request.Method.POST,
        Constants.URL_Login,
        new Response.Listener<String>() {
            @Override
            public void onResponse(String response) {
                progressDialog.dismiss();
                try {
                    JSONObject obj = new JSONObject(response);
                    if(!obj.getBoolean("error")){

                        SharedPreferences.getInstance(getApplicationContext()).userLogin(
                            obj.getInt("id"),
                                obj.getString("username"),
                                obj.getString("email")
                            );
                        startActivity(new Intent(getApplicationContext(), homeScreen.class));
                        finish();
                    }else{
                        Toast.makeText(getApplicationContext(), obj.getString("message"),
                            Toast.LENGTH_LONG).show();
                    }
                } catch (JSONException e) {
                    e.printStackTrace();
                }
            },
            new Response.ErrorListener() {
                @Override
                public void onErrorResponse(VolleyError error) {
                    progressDialog.dismiss();
                    Toast.makeText(getApplicationContext(),
                        error.getMessage(), Toast.LENGTH_LONG
                    ).show();
                }
            }
        ) {
        RequestHandler.getInstance(this).addToRequestQueue(stringRequest);
    }
}
```



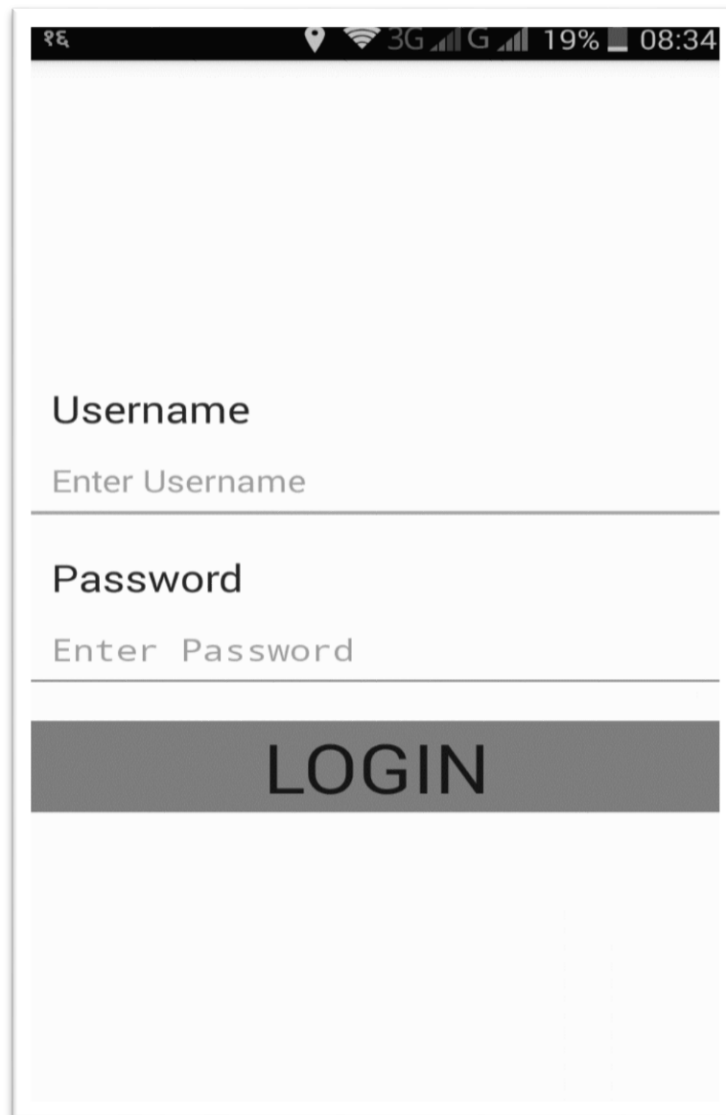


Figure 29: Login Screen of Sahaj Ambulance

The image in the figure 30 shows the login screen of the Sahaj Ambulance. The user login procedure is carried out in two steps. In the first step, check for empty fields are carried out. If any one of the field is empty, then the user is asked to fill up the empty field. When both the fields have been filled and user taps the login button, a check is carried out with the database to see if the correct username and password have been provided by the user. If correct login credentials have been provided, then, the user is redirected to the home screen else the user is notified about invalid username and password and login is not granted.

## 4.1.4 Home Screen

### Function Prototype:

```
public class homeScreen extends AppCompatActivity {
    private TextView textViewUsername, textViewContact, textViewEmail;
    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_home_screen);

        if(!SharedPreferences.getInstance(this).isLoggedIn()){
            finish();
            startActivity(new Intent(this, loginscreen.class));
        }
        textViewUsername = (TextView)
        findViewById(R.id.textviewUsername);
        /*textViewContact = (TextView)
        findViewById(R.id.textviewContact);*/
        textViewEmail = (TextView)
        findViewById(R.id.textviewEmail);
        textViewEmail.setText(SharedPreferences.getInstance(this).getUserEmail());
        textViewUsername.setText(SharedPreferences.getInstance(this).getUserName());
    }
    @Override
    public boolean onCreateOptionsMenu(Menu menu) {
        getMenuInflater().inflate(R.menu.menu, menu);
        return true;
    }
    @Override
    public boolean onOptionsItemSelected(MenuItem item) {
        switch(item.getItemId()){
            case R.id.menuLogout:
                SharedPreferences.getInstance(this).logout();
                finish();
                startActivity(new Intent(this, registerUser.class));
                break;
        }
        return true;
    }
}
```

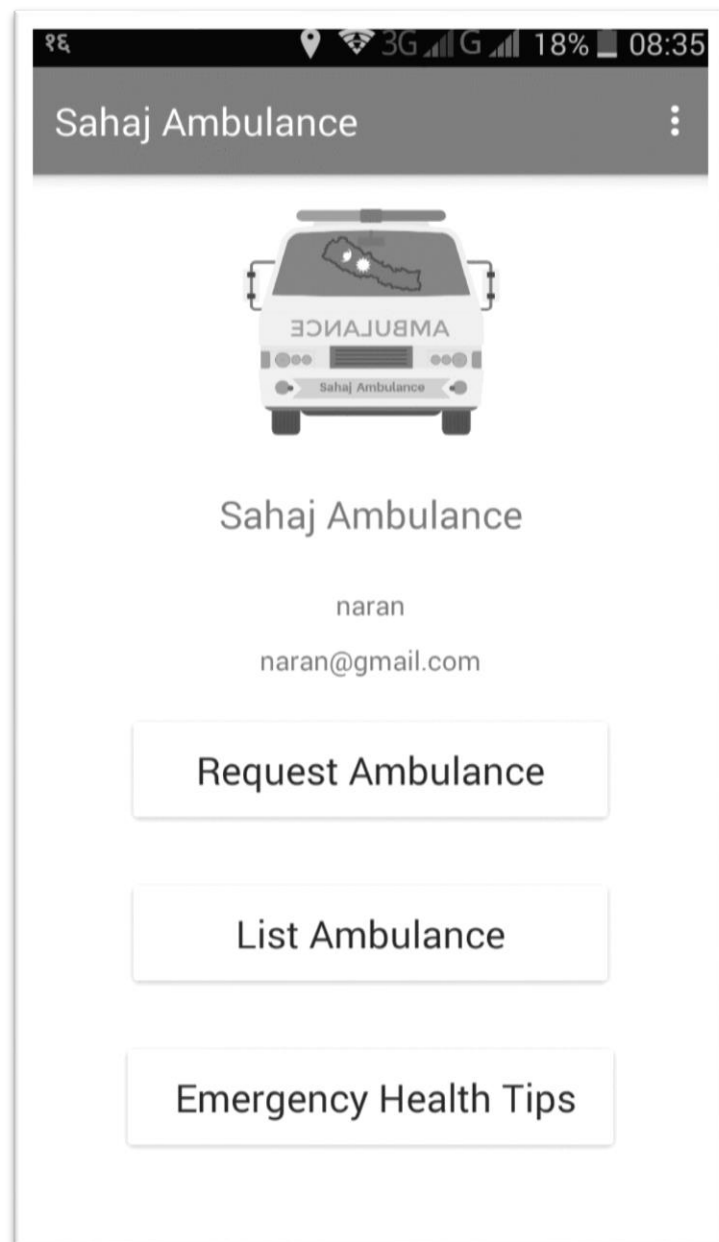


Figure 30: Home Screen of Sahaj Ambulance

The image in figure 31 shows the home screen of the Sahaj Ambulance. When the already logged in user opens the app, the splash screen will be directly redirected to this screen and for the users who have not logged in, they will have to login first and then will be redirected to this screen. The home screen provides menu for all three operations that can be performed in Sahaj Ambulance. The user name and email address is also displayed in the home screen so as to keep the user aware about the account in use.

## 4.1.5 Ambulance Requesting Screen

### Function Prototype:

```
public void onCreate() {

    super.onCreate();

    Toast.makeText(this, "Location update service is started",
    Toast.LENGTH_SHORT).show();

    googleApiClient = new GoogleApiClient.Builder(this)

    .addApi(LocationServices.API)          .addConnectionCallbacks(this)
    .addOnConnectionFailedListener(this).build();

    locationRequest = new LocationRequest();
    locationRequest.setInterval(TIME_INTERVAL);

        locationRequest.setFastestInterval(FATEST_INTERVAL);

    locationRequest.setPriority(LocationRequest.PRIORITY_HIGH_ACCURACY);

        googleApiClient.connect();

    }

    @Override

    public void onLocationChanged(Location location) {

        myLatitude = location.getLatitude();

        myLongitude = location.getLongitude();

        Log.e("Latitude",myLatitude.toString());

        Log.e("Longitude",myLongitude.toString());

        if (!isGPSEnable && isNetworkEnable ){

    Toast.makeText(getApplicationContext(), "Please check your gps and
    network status", Toast.LENGTH_SHORT).show();

        } else {

            sendToServer();

        }

    }

}
```



Figure 31: Ambulance Request Screen

The image in the figure 32 shows the ambulance request screen from which the user can select the ambulance service provider and the request for ambulance. A list of the available service providers will be given to the user and then the user can select the ambulance as per the location convenience.

#### 4.1.6 Tracking the Ambulance

Function Prototype:

```

public void getGpsData() {

    final Handler handler = new Handler();

    final Runnable r = new Runnable() {

        @Override

        public void run() {

handler.postDelayed(this, Constants.MINIMUM_UPDATE_TIME);

StringRequest stringRequest = new StringRequest(Request.Method.GET,
Constants.DATA_URL, new Response.Listener<String>() {

    BitmapDrawable bitmap = (BitmapDrawable)
getResources().getDrawable(R.drawable.icon_bus);

    Bitmap b = bitmap.getBitmap();

Bitmap icon_bus = Bitmap.createScaledBitmap(b, 100, 100, true);

double lat = Double.parseDouble(LAST_KNOW_LATITUDE);
double log = Double.parseDouble(LAST_KNOW_LONGITUDE);

    if (marker != null){

        marker.remove();

    }

marker = mMap.addMarker(new MarkerOptions()

        .position(new LatLng(lat, log)).title("Current Location")

        .icon(BitmapDescriptorFactory.fromBitmap(icon_bus)));

        }

        }, new Response.ErrorListener()

@Override

        public void onErrorResponse(VolleyError error) }

};

```

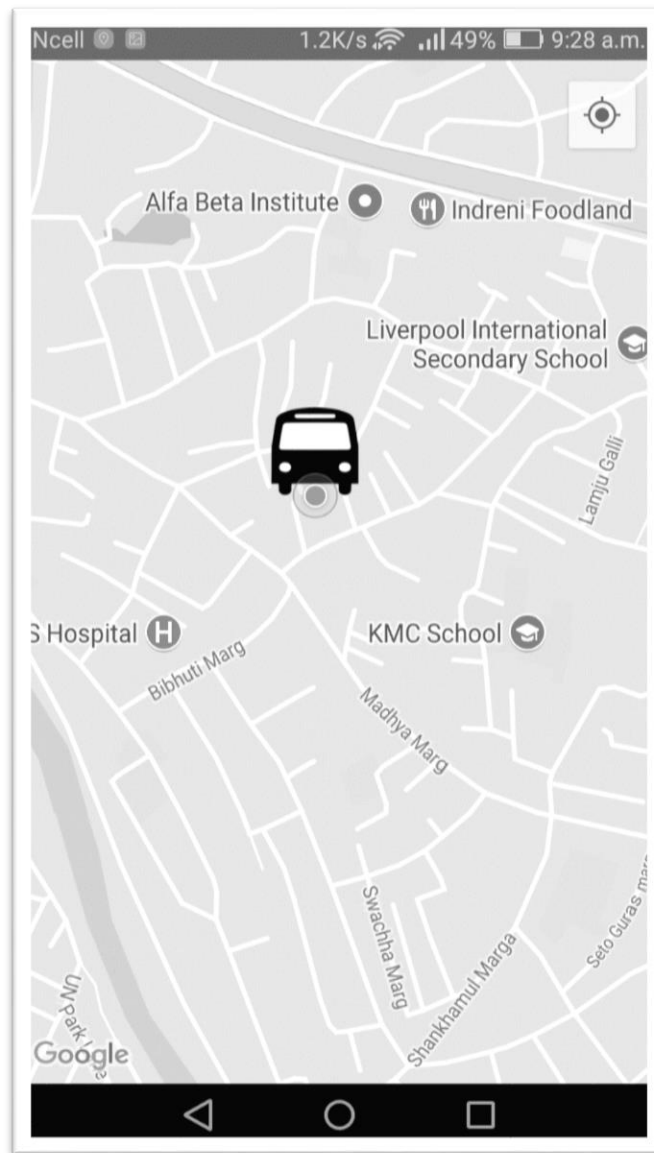


Figure 32: Tracking the ambulance

The image in the figure 35 shows the tracking of the ambulance that is in on its way as per the response to an ambulance request. Once the ambulance service provider starts the service, the user will then be able to track the ambulance in the same way as shown in the figure above. This will give users real time idea of where the ambulance has reached at that instance of time. The tracking will update frequently so the tracking can be considered as the real time tracking without any lag.

#### 4.1.7 Ambulance Directory Screen

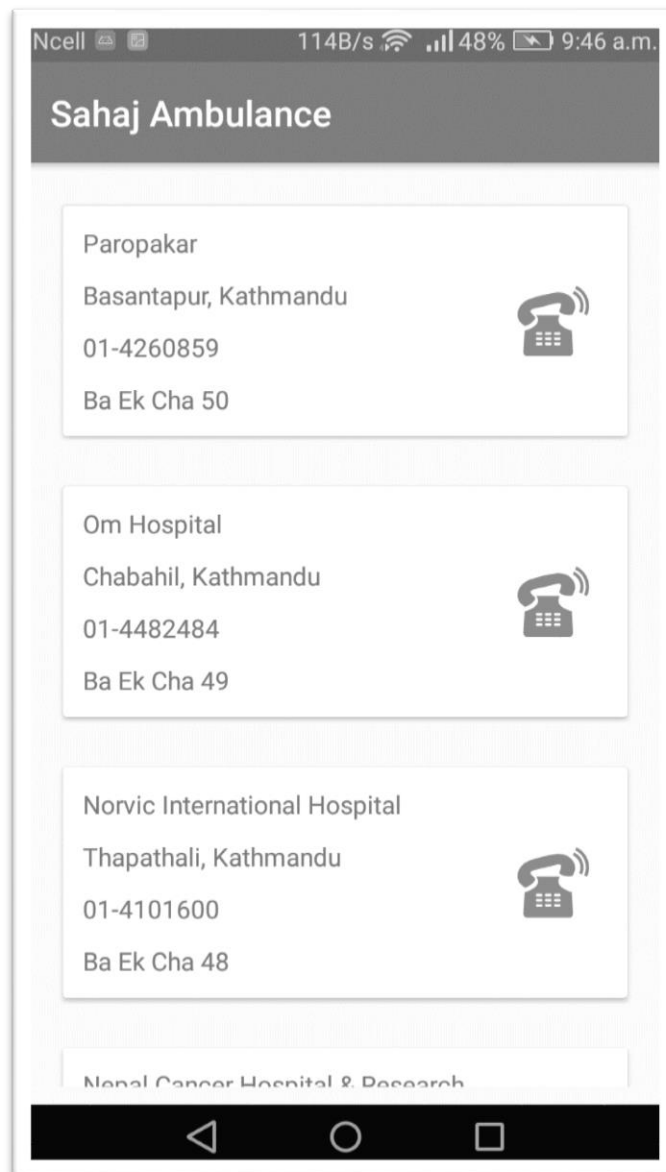


Figure 33: Ambulance Directory Screen

The image in the figure 36 shows the another available operation of this project which is to provide an updated ambulance directory to the user. The user will get all the details of the service provider such as the name of the service provider, location, contact number and the number plate of the associated ambulance of the service provider. Additionally, the user will be available to call the ambulance service provider directly from this application.



#### 4.1.8 Immediate Help Tips Screen

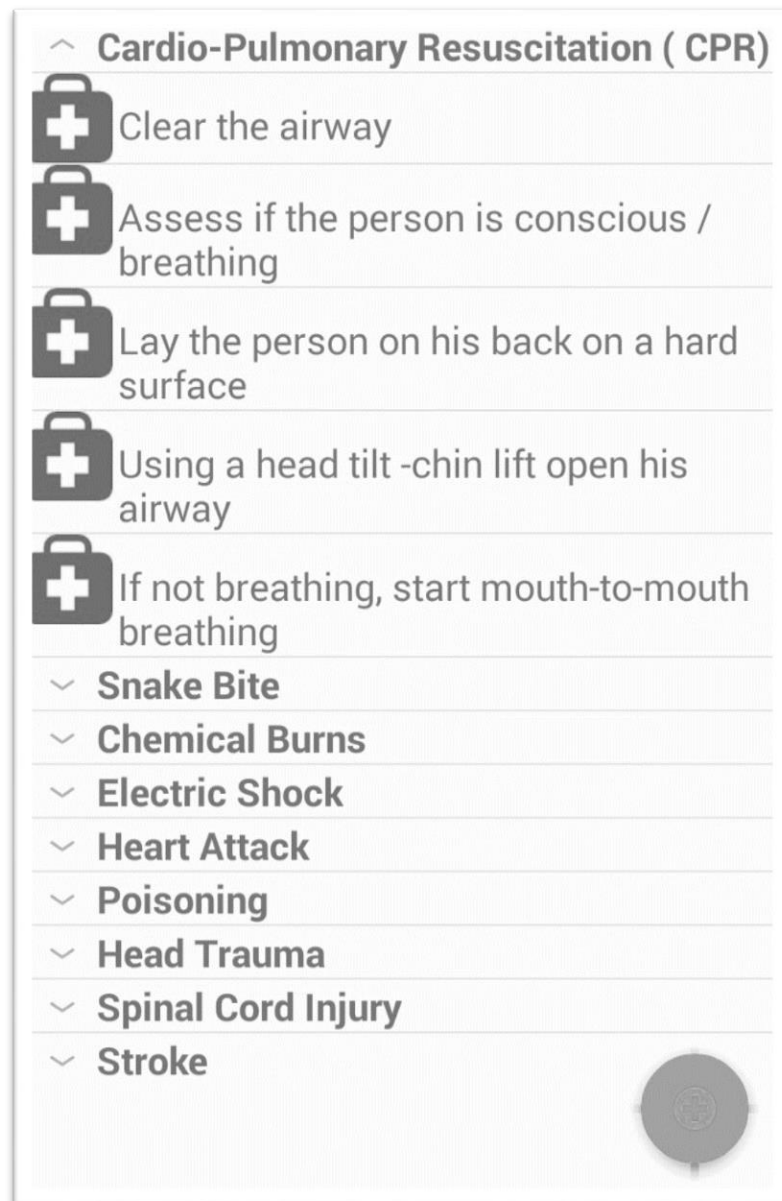


Figure 34: Immediate Health Tips Screen

The image in the figure 37 shows the immediate health tips screen of the Sahaj Ambulance. In case of emergencies or while the ambulance is still on the way, the user can get related home-based treatment tips that will prevent the situation from worsening and can help to bring the situation under control.

## 4.2 Critical Analysis

Information and Communication Technology has made impacts in every aspect of human life, the only difference is the level of impact it has made. Humans in the developed countries have started being dependent on ICT for almost everything, even for buying groceries. But the scenario is quite different in developing countries like ours where technology is gradually growing and people are slowly adapting to it. The major problem is evident as: technology for the daily life operations being concentrated in only certain age group. The main hindrance seen among people adapting to technology has been the doubts and uncertainty regarding its security and trustable service. People are skeptical as to whether they will get reliable service from the technology related resources.

In context of the Nepalese society, the acknowledgement of technology has been growing. However, the growth has not been even in all aspects of human lives. Fields such as transportation and health care are yet to incorporate technology in the scale as of commerce and social networking. Only few initiatives have been taken in these fields and the general people are still not sure to utilize the services provided by them. A large number of people acknowledging technology, in contrast, use the basic web-service as Google Maps very rarely. In this scenario, Sahaj Ambulance is seen as an initiative to incorporate technology in the field of transportation for health care. Sahaj Ambulance primarily targets the ambulance service which is one of the most important aspect of health for human life. At the present context, not a single governmental or non-governmental body having a complete inventory of ambulances are seen in operation. The technology-incorporated ambulance service to such scenario becomes a remote assumption and unviable in imagination.

The ambulance service is also not as efficient as it should have been, considering the high level of associativity between the ambulance service and human lives. Generally, people in case of emergencies have to scan for phone numbers in newspapers or hospital documents. These procedures can take a lot of time considering the emergency. Thus, Sahaj Ambulance acts as a single hub to get contact details of ambulances operating in

the Kathmandu valley. Getting information about the ambulances at one platform will save a lot of time and also make the process a lot easier. Sahaj Ambulance is not limited to the listing of ambulances. It also serves as a new initiative wherein ambulances could be requested just from a single touch at the current location. This feature of Sahaj Ambulance believes to link people with technology, widen their idea of technological services and build their trust on technology. While, the major target would always be on serving people during emergencies such that they do not have to encounter the problems they face, generally with the traditional approach.

The service of ambulance is equally important to everyone as human life is unpredictable and anyone may need the ambulance service at any instant. Ambulances are associated with the life and death of a person; thus, a prompt service is a must. At the present scenario there is no other better option than incorporating technology for this service. Among all the technological devices, smartphones are on the top of the list. As today's user-friendly interfaces have made people addicted to their phones, developing a system for mobile would serve as the best choice. Additionally, the mobile system would also be inclusive of a wide range of users.

Sahaj ambulance with very simple operations to perform can with ease allow anyone to request the ambulance. Considering the emergency need, the users do not need to provide information through any additional form. They will just have to press one button and the required details such as username and contact will be sent from the registration detail. The operation has been designed to be as simple as possible and easy to use. The User Interface (UI) with needed concerns has been made very minimalist with more focus been given to the service. The main objective has been to provide a life associated service through a simple operation following easy to use interfaces. The operations have been made very simple such that anyone can use the application easily, without any expertise. People of any age can use the application and benefit from the service.

The present scenario of road transportation has been a major concern for this project. It is not that every ambulance service is slow in their service. There are service providers

who give prompt responses; however, the main issue lies in the journey from the hospital to the patient's location. Once the ambulance leaves the hospital to pick up the patient, the patient will have no idea of where the ambulance has reached. The only possible way is to make a phone call. A phone call may not be always feasible as the driving rules prohibit the use of mobile phones. Also, the location told will just be an approximation in most of the cases. Thus, one of the considerable aspect of Sahaj Ambulance is the tracking facility of the ambulance. Once the ambulance has left the hospital, the user will be able to track the ambulance throughout its journey, having a clear idea of where the ambulance is at present.

This project has been built using Android Studio as it is the best IDE for android development with a lot features assisting the developers and development of the project. It provides faster automatic code completion which makes it a lot easier for the developers. Android Studio provides an interactive development for designing the layout using the XML and business development logic can also be developed easily using Java programming language. Android Studio provides better project organization than other IDEs which sets it at the top. The layout built using XML has been designed to be as simple as possible; but with the provision of required verification tools such as checks for empty fields and email verification. PHP has been used as the server side scripting language and to connect the database operations with the application. Regarding the database operations, MySQLi has been used. The project has been run on a free web hosting server thus not confined to any localhost. It can be accessed regardless of the changes that would occur in the device used for the development, a prime concern for hosting any project in the localhost.

Sahaj Ambulance has been seen as an initiative to bring out the real potential of technology and the impact it can have on human life. The project being the first developed version of this initiative can be advanced to a larger extent regarding its functionality and operations. The project at current lacks password retrieval and if a user loses his/her password there is no feature to retrieve it. This, however, can be implemented in the project in the coming days. As only one account per phone number is possible, it is suggested that the user would not log out of the system. A small fraction

of time can lead to some unwanted consequences and as the application is for the purpose of covering emergency needs, being logged always is a better option. Being an emergency situation prompt service provider, requesting ambulance for the purpose of fun or other irresponsible purpose could lead to undesired situations of the service. Even one such irresponsible act can prevent the person needing the service from getting the service.

In many cases, a simple home based step taken can also prevent the situation from worsening. Following this idea, Sahaj Ambulance also has some home based treatment tips that could be very useful while the ambulance is still on its way or in cases of emergencies such as chemical burns, shock, electric shock that could have adverse effect on the health.

The project has been developed in the limited time due to which there are a lot of rooms for improvement and advancement which shall take place with the course of time in the future.

### **4.3 Applications of the System**

- **Request Ambulance:** This application can be used to place requests for ambulance whenever required from any place inside the Kathmandu valley. The service providers will be listed in the interface and the user can then select the ambulance and request them. Since the application has been developed for emergency cases so the user will not have to fill up any additional forms as the details of the user provided during the registration will be used.
- **Ambulance Tracking:** One of the main application of Sahaj Ambulance is to be able to track the ambulance while it is on its way to pick up the patient. This way the user will have a clear idea of where the ambulance is and can take necessary steps rather than just approximation.
- **Immediate Help:** Keeping in mind the fact that emergency conditions can at time be brought under control or the consequences can be reduced by a large scale by following procedures of some home based simple treatment, the

application provides list of immediate treatment help to make an attempt to help the patient's family.

- Single Point of Information: A complete updated inventory of service providing ambulances of Kathmandu is not available conveniently and following this limitation, Sahaj Ambulance provides a list of Kathmandu valley based operating ambulances with an option to call them directly from the application.

#### **4.4 Limitation and Future Enhancement**

Though a lot of effort and study has been invested on this project, this project still lags in few places, which can be improved in the future. Some of the limitations of the project are:

- i. No time calculation during tracking  
At the present level, the user can only locate the ambulance on the map but cannot know how much time will it take for the ambulance to reach the user.
- ii. No implementation of shortest path suggesting algorithm  
The developed project at present doesn't suggest the driver the shortest path to reach the destination following the shortest path detection algorithms. The driver will have to decide the way him/herself.
- iii. No history of rides kept distinctively per user  
A separate records dedicated just for the requests placed by the user is not maintained. The user cannot afterwards know when had he/she requested for ambulance and get the journey details.
- iv. No information about availability of ambulance  
The user at the present scenario cannot know if any ambulance is available for service at the current time or not.
- v. Driver's information not shared with the user  
The only information that users get is the details of the organization providing the ambulance service. Until the ambulance arrives, the user will have no idea about the driver coming up to pick the patient.
- vi. E-mail confirmation for user registration

The user can register for a new account by just filling up the simple form in the registration menu. No any further steps are taken to verify the user. Thus, the account creation process will be very easy.

On the basis of given limitations, following would be the future enhancements:

- i. The time needed for reaching the destination will be calculated following algorithms dealing with distance, speed and time.
- ii. An API for suggesting the shortest route will be implemented.
- iii. A separate section under profile can be maintained for keeping record of all the service requests by the user.
- iv. A feature of availability can be added to the driver app so that they can give information about their availability under headings of available or not available.
- v. Once the ambulance service provider starts the service, an implementation can be made to share the driver's detail such as name and phone number along with the location.
- vi. Reliable password retrieval feature will be developed and added in the application

## **4.5 Conclusion**

Information and Communication Technology is gradually growing in Nepal. Even though the rate of growth may be very slow, but the positive aspect is that in a developing country like Nepal it is growing and people are slowly adapting to technology. This project has been developed with two major objectives, the primary being to provide ambulance service and related helps with ease and the secondary to help people assist in acknowledging technology in their daily life. The project is related to one of the most complex life issues thus providing a reliable service will definitely make people use the service and in return be benefited by the service.

One of the main concern of this project is to be able to track the ambulance on the way to provide service. In context to the present traffic scenario where the traffic flow gets affected time and again, being able to know where the ambulance is exactly at that

instance of time will be a great help. The user requesting the service will have a clear idea and being able to track the location will not lead to phone calls to the driver which will prevent any consequences that could occur with the disturbance while driving.

At the present scenario, different applications for ride sharing have also been developed but people are still in doubt regarding the service of the application and the associated rules and regulations for some of the application while some of the applications have been developed but they do not function or have not maintained. Looking at this scenario, this project aims to give provide the required services and also build trust among people for using and recommending the service. The project has been built such that no any additional resources are required for its operation. The user can simply install the application and use it right away for the service. The project aims to enhance the ambulance service both aspects, the service provider and the user and build a technological ground for the technological implementation in transportation and medical related services.

This project being an initiative surely has lots of room for improvement for its full-fledge operation. The authors are well aware about the limitations that are existing in the application at this stage of development. The further improvements and update would include the time calculation for the driver to reach to the patient's location. Similarly, the future development would include suggesting the best route along with other possible routes for the driver so that if any of route is not available the driver can take the other route. This feature will help both the service provider and the user.

The password has been encrypted with using MD5 encryption algorithm to ensure data security. However, password retrieval functions are yet to be added in the system so that the user can get back to his/her account in case he/she forgets the password.

The project has been built for the most used mobile operating system thus its usage covers a wide range of people. Additionally, the project has been built as simple as possible regarding both the requirements and the user interface. The project for larger implementation can have their dedicated cameras installed in the streets that would provide information about the traffic density at different places which would help to determine the routes and make the driver aware of the traffic condition. Adding more



required functionality and operating this project in full fledge in real time can bring a breakthrough in the technological background of Kathmandu valley along with the public services of transportation and ambulance.

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