TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

HIMALAYA COLLEGE OF ENGINEERING

A MINOR PROJECT REPORT

ON

HEALTHCARE ASSISTANT

[CT 654]

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SUBMITTED TO:

DEPARTMENT OF ELECTRONICS AND COMPUTER

HIMALAYA COLLEGE OF ENGINEERING

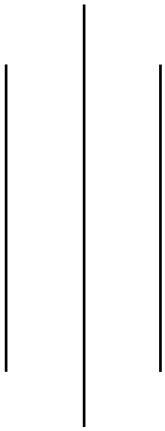
CHYSAL, LALITPUR

August, 2017

HEALTHCARE ASSISTANT

A THIRD YEAR PROJECT REPORT

[CT 654]



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"A MINOR PROJECT REPORT SUBMITTED FOR THE PARTIAL FULLFILLMENT OF THE REQUIREMENT FOR THE DEGREE OF BACHELOR'S COMPUTER ENGINEERING"

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August, 2017

ACKNOWLEDGMENT

Primarily, we would like to convey our sincere and heartfelt thanks to HOD Er. Ashok GM & Deputy HOD Er. Devendra Kathayat (DOEC, Himalaya College of Engineering) for his advice and support that boosted our project and research idea. Your advice was important for this achievement.

We would like to express our gratitude thanks to our coordinator Er. Narayan Adhikari Chhetri for his guidance, motivations and kindness throughout our project who devoted his precious time from his busy schedule.

We would like to express our sincere thanks to our project supervisor Er. Pujan Bashyal for his guidance, constructive and invaluable suggestions that helped us to reach this achievement. Your support was invaluable and key for the success for this project.

We would appreciate all the teachers and respondents who took out their valuable time to give their views and fill the questionnaire. Your response to our questionnaire was important to the success of our project.

Lastly but not the least, we also take this opportunity to thanks our friends and colleagues for their support and feedback throughout this project. We thank you all.

ABSTRACT

This is an Android based Healthcare application in which user-friendly interface between system and users is implemented with recent mobile web platform technology that focuses on all category of people such as, children, business, patients, housewives, teachers and all of us have busy hectic schedule. This also sets up easy and optimal solution of communication between hospital and a user via mobile device with web server. In addition, using this application, the user can make an appointment to meet the doctor in clinic/hospital. Similarly, this application is also beneficial to uneducated peoples by providing user interactive functionalities like body part click feature. Nevertheless, if user don't have any idea and information about their body health treatment process, so this app is useful to get suitable information about doctors, hospitals and related health services. Unlike other health care android applications, "Healthcare Assistant" has unique features for all people and providing a vital communication link between users, and clinic/hospital or connecting doctors with the help of technology from anywhere, everywhere.

Keywords: *HealthCare, Hospitals, doctors, diagram, statistics*

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LIST OF ABBREVIATIONS

API	:	Application Program Interface
APK	:	Application Package File
App	:	Application
BCT	:	Bachelor in Computer Technology
BMI	:	Body Mass Index
Er.	:	Engineer
HOD	:	Head of Department
IDC	:	International Data Corporation
IDE	:	Integrated Development Environment
IoT	:	Internet of Things
JSON	:	JavaScript Object Notation
OS	:	Operating System
SDK	:	Software Development Kit
SQL	:	Standard Query Language
UML	:	Unified Modeling Language
XML	:	Extensible Markup Language

CHAPTER 1: INTRODUCTION

1. INTRODUCTION

1.1 Background

Technology is evolving at a faster pace, than it was a decade ago. With the advent of hand-held mobile devices, technology has reached all segment of population. The device manufacturers are striving hard to enrich the user experience with easy-to-use mobile phones, tablets etc. There are a number of applications that are being developed to run on these devices. To back these applications, device needs a powerful operation system and one such OS which is the major technological breakthrough is Android. The increase in number of mobile phones having Android Operating System has result in increase in number of third applications. There are number of applications which have brought together Technology and many other fields. One such application tried for effective health care between doctor and user is "**Healthcare Assistant**".

In our developing and technology, dependent life we totally rely on gadgets especially smart phones. Today everyone has a smart phone. With this we get an opportunity to use technology in a better way so that it can be made useful to us, and it plays an important part in our daily life that helps us staying fit in many ways. The category of user involves all human beings' teachers, students, businessman, and children and also all of us have busy hectic schedule. Today's life is full of responsibilities and stress. So, people are prone to diseases of different types and it is our duty to make ourselves stay fit and healthy.

So, we design an Android application whose objective is to provide the user-friendly health care assistant for users through visualizing the different parts of body on their installed app so that they can directly get or contact related doctor by selecting user's problems. They can select and contact doctors with their available time so that they can easily get proper treatment on time from anywhere. This application focuses on the people who don't know about doctors or hospitals information, and also works as proper assistant for different people's males/females/children. And, the concept is based on the databases with system web server along with user-friendliness mobile android phone application.

1.2 Objectives

The system is based on Android Operating System which facilitates the users to get proper health assistant with the available doctors in the system server. The main objectives for the developing this android app are as follows:

- To provide user friendly health-care interface by clicking body parts and navigate to time-wise doctor's details.
- To fetch and recommend the available doctors from database with easy, sorted and optimal way for treatment.

1.3 Motivation

It is quite possible that patient/non-patients/users may not remember all the questions which they want to ask a doctor when they meet in the hospital. So, we design this app to overcome this problem by providing calling service for users. Apart from the above, Healthcare Assistant also facilitates making appointments with the doctor, patient's referrals to other specialists dealing with similar patients. Through all these functionalities "Healthcare Assistant" fulfills the basic needs of the patients which are totally non-commercial and beneficial to all patients, non-patients or doctors.

1.4 Problem Statement

Many medication or health-care system applications have been developed based upon different platforms and concepts. In the current marketplace, there are several apps for communication between doctors and users but most of their functionalities are commercial, and not really helpful to the users. There are no apps which actually meet the user's basic needs and no such apps that fulfill the user's expectations from the doctors. This project aims at changing this kind of misleading, with a new initiative which focuses more on user benefits relating to his/her disease treatment and facilitating the users with an easy and optimal way to receive the health services.

1.5 Scope and Limitations

This product is developed for smart phone users, especially for android platform, as we know how the smart phone market has evolved in the last few years. There are many operating systems available for smart phones but we opted the Android Application OS for developing this product because it has a very good user bank worldwide. Since, there are other mobile technology such as apple OS, windows phone such that this application isn't recently available on other platforms.

1.6 Report Structure

This report has been organized into chapter. Each chapter contains some description or background or introduction and also, organized into sub-heading with numbering. There are also different figure representing this project and they are organized on List of Figure. Chapter 1 describes the project Introduction, objectives and related information. Chapter 2 contains the review of different statistics of mobile and healthcare technology, documented as Literature Review. Chapter 3 shows the project Requirement Analysis of different software and hardware requirement used during the development of this mobile application. Similarly, chapter 4 categorized with various sub-topic describing about project details Methodology. This section also includes all necessary diagram, application testing environment and different design, module or components. Chapter 5 documented as Result Analysis of our project. In final, the chapter 6 provides the Conclusion and Future Enhancements, work to this project.

CHAPTER 2: LITERATURE REVIEW

2. LITERATURE REVIEW

Due to the fact that mobile services in an emerging field, many researchers or developers have been devoted to conduct studies in various application areas. However, few studies have been carried in the developing world on mhealth (mobile health) application in general. Therefore, we put our literature review focus on the mobile technologies and available open source frameworks that can be used to improve health data collection and reporting process from primary to secondary health facilities. The establishment and improvement of healthcare system is a very important requirement, especially now when the mobile communication technology is developing rapidly. The advantages of mobile app can be made to make up the time and distance gap between doctors and patients/users and to provide fast and adequate medical services.

2.1 Smartphone Statistics

Mobile technology growth faster than desktop system [1]. In 2012, total 46 billion apps were downloaded in the year. That is certainly a rapid growth in market. In 2013, about 90 per cent of the mobile phones purchased were smartphones, and between 2012 and 2015, the number of smart phone users over the desktop users is only increased by about 0.75 billion. Accordance these analytics, we can say that the mobile user in the recent scenario, 2017, have very huge amount of global user. And day to day these users are increasing than desktop users.

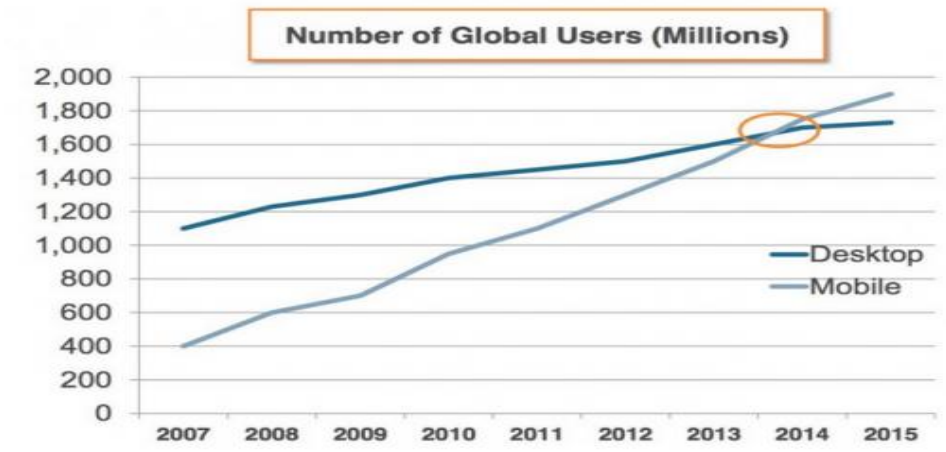

Figure 2.1: Global Mobile Users Statistics

The popular mobile operating system in the market as per 2016 are [2];

- Google's Android
- Apple's IOS
- Windows Phone
- RIM Blackberry

Figure 2.2 shows that there is a rapid growth in the Smartphone, especially on Android Device. According to data from the International Data Corporation (IDC), [2] the worldwide smartphone market grew 1.1 percent year over year in 2016. Android dominated the market with 86.8%+ share in 2016Q3, followed by iOS at 12.5%, and Windows phone at 0.3%.

Period	Android	iOS	Windows Phone	Others
2015Q4	79.6%	18.7%	1.2%	0.5%
2016Q1	83.5%	15.4%	0.8%	0.4%
2016Q2	87.6%	11.7%	0.4%	0.3%
2016Q3	86.8%	12.5%	0.3%	0.4%

Source: IDC, Nov 2016

Figure 2.2: Smartphone Worldwide Statistics

2.2 Telemedicine & Healthcare Technology

Telemedicine, Tele-health, m-health and connected health are all terms that pertain to the use of telecommunications and information technology in order to provide electronic assisted healthcare services. They form the ecosystem that contains all standards, businesses, operations related to the industry of electronic healthcare, which include a wide range of stake holders including patients, doctors, physicians, nurses, and more.

The fast-growing area of healthcare it solutions is encompassing many different technologies including Internet of Things (IoT), broadband wireless, robotics, telepresence, artificial intelligence, machine communications, big data and analytics. According to the past research, they provide a technology and market assessment for healthcare, telemedicine, and mHealth [3].

In medicine and healthcare, digital technology could help transform unsustainable healthcare systems into sustainable ones, equalize the relationship between medical professionals and patients, provide cheaper, faster and more effective solutions for diseases. Mainly, technology transforms healthcare which are listed below [4]:

- Artificial Intelligence – artificial intelligence has the potential to redesign healthcare completely.
- Virtual reality – Virtual reality is changing the lives of patients and physicians for healthcare technology.
- Augmented reality – Differs from Virtual Reality: users do not lose touch with reality and it puts information into eyesight as fast as possible. These distinctive features enable Augmented reality to become a driving force in the future of medicine. Bot on the healthcare provider's and the receivers' side.
- Nanotechnology – nanoparticles and nanodevices will soon operate as precise drug delivery systems, cancer treatment tools or tiny surgeons.

2.3 Healthcare Related Apps

At present scenario, there are more apps on the android marketplace, and even a medical category on the market that point toward the continued presence of android in the competition for the hearts, minds and wallets of health care professionals and students. From android marketplace apps, there are many healthcare related apps for doctors, patients and physicians, and also most of them are only for commercial purpose. The free medical assistant apps available in the marketplace provide only less user-friendly environment and don't have proper patient's education category. Due to the numerous pictures of each app or in-depth

commentary, each app has its own page and description. Some of these apps will not be available on certain platforms of Android Operating System – especially older phones.

Generally, we found fitness app, mobile BMI calculation and weight apps, iCare app and other simple health tips apps. Few free apps related to the healthcare assistant are listed below;

- Health Assistant App [5] – Help in maintaining or improving the state of health by monitoring a wide range of health parameters having various features likes medical reporting or graphs, health diary, medication planning, remainders, calculation of BMI, medical family interviews etc.
- Doctor Assistant [6] – Electronic Medical Record app that helps health professional stay organized and improve productivity. Designed to fit busy schedule with basic features likes patient health record with date and time stamp, biodata autofill as well as date and time for new appointment.
- Hamro Doctor [7] – Produce in-depth health related news and articles while also earnestly developing database on doctors, hospitals and blood donors profile with app likes medicine tracking, health videos, hospital/clinics/doctors/blood donors search features.
- Hamro Hospital [8] – Mobile app that provides detail information about hospitals, doctors with the features of making appointment and also, allow patients to look at the available slots and book an appointment when required and stores their records and associated history.

CHAPTER 3: SYSTEM REQUIREMENT

3. SYSTEM REQUIREMENT

This application is developed on the Android software stack produced by Google. Android is an open source framework designed for mobile devices. It packages an operating system, middleware, and key programs. The Android SDK provides libraries needed to interface with the hardware at a high level and make/deploy Android applications. Application is written in Java and use databases to store persistent data and access or fetch the information with the help of JSON, XML documents. We choose this platform as opposed to others because of the ability to easily thread background running processes, the polished Navigation API, and compatibility with other Android devices. Unlike dedicated systems this software is intended to integrate with the device's existing applications and basically, the requirement for developing android application needs. Android Studio is the official Integrated Development Environment for Android application development, based on IntelliJ IDEA.

3.1 Android Operating System

This project is based on user-doctor communication system via mobile technology and developing for the Android Operating system. Android is a Linux based operating system, primarily designed for touch screen mobile devices such as smart phones and tablets. Android is compatible with multiple hardware and supports various features like Web browser, Email, Java, Video calling, Media streaming, Bluetooth, Wi-Fi, Multitasking, External storage, Screen capturing, and etc. Here, we create healthcare communication system based on Android device through which user can access doctor's details on their own mobile device. we focus about health sector problems by proposing a new system based on android technology, through that the doctors, patients or users can manage his/her appointments from anywhere. In addition to this the patient who is unable to go to the clinic and take the appointment can also book his/her appointment from a mobile phone via build-in calling android function. Our solution is to build a system that will help the needful people or every person who wants to save their precious time.

The reasons for choosing Android operating system for developing this application are as follows:

- It is an open source technology with lot of features and good user experience.
- Large number of users use Android based smart phones, so that our app can serve more people in the mobile industry.
- According to the market survey, it has the highest number of applications available for download on Google play store.
- It is also popular among the other operating systems which focus on low cost, customizable, and a ready-made operating system.

3.2 Google Android Platform

Google Android platform (Android Studio – IDE) is an open source software platform for mobile devices, it is composed of operating system and open libraries that are free of charge worldwide to be used by researchers and developers [9]. Being an open source software platform means it has a large supporting community to improve the software and fix bugs and that has been one reason that the Android platform gained popularity in recent years. The architecture of Android is comprised of four main layers each with its own functionality. The layers are the application layer, which obtain core applications such as email and SMS program, the application framework layer, which provide standard structure for specific operating system, the libraries layer, which contains a set of procedures that are invoked by applications, and the kernel Linux layer where the applications are executed. Another important feature that makes this platform popular out of the others is its ability to optimize the usage of memory. Multiple processes can run in the Android platform, each process consuming low memory. This feature gives us more confidence on the suitability of this platform in data collection as health data collection forms may require more memory that could not be offered by other platforms.

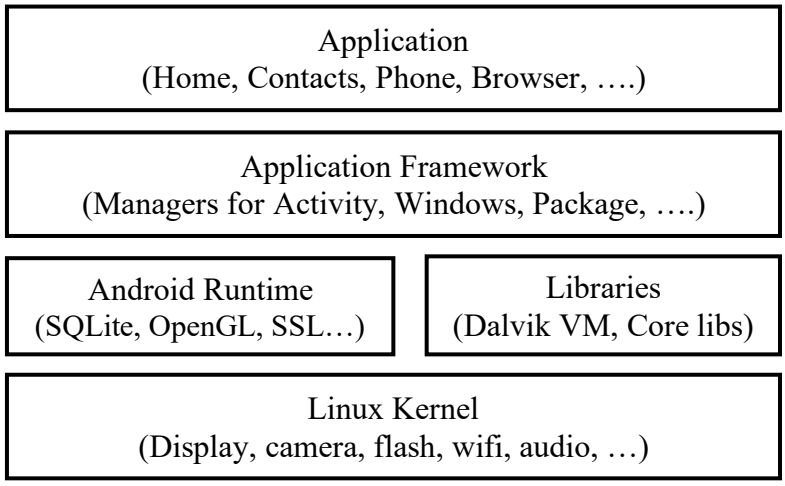

Figure 3.1: Android Architecture

3.3 Web Server & JSON

Web Server, generally our database system to handle the doctors and hospital complete information, is designed with most efficient way such that user can get proper result through our database recorded data. The system of webserver is worked on SQL based program, Android build-in Firebase software that provides suitable database development tools for application with the help of Database Connectivity within the Studio. In first phase of database, we record or input our all available doctor's information such as pictures, name, degree, department, time and other data into the database table, implement with SQL functions. The data can be retrieved from database with the help of JSON. JSON is lightweight data-interchange format or alternative of XML. It is easy for humans to read and write and also for machines to parse and generate [10]. JSON provides various structure of different collection of name or value pairs. In android development, JSON realized the JSON object, array to retrieved the data from database. Basically, the webserver is taken for developing database system with doctors and hospital information and using JSON, the data is retrieved from database to mobile application. All the required queries, functions, algorithms and necessary parsing data are set to the database so that database can fetch user request quickly and most efficiently from devices.

CHAPTER 4: METHODOLOGY

4. METHODOLOGY

For the development of **"Healthcare Assistant"**, we use Android Studio. Android platform has a software stack with operating system, middleware and key application. Healthcare Assistant works on the basis of web servers so that doctors' information is stored in the database system and while user accessing the application, the nearest and finest result comes via parse web server. In the Healthcare Assistant Android app, we design the human body part of the male, female and child. So, with the visualization of human body section, user can touch the different part of body and immediately this user responds to request from web server and get proper result of doctor's information on their smartphone device. The different parts of body have their specific doctors' information. Once the information displays on user's device, user can have different functions such as call hospitals, get information about doctor's details and also, get available time of doctor in hospital with timewise quickest hospital search functionality. By location trace of nearest clinic or hospitals, users get fast treatment from doctors or hospitals. Normally, call hospitals, know about doctors and see their duty time period. Nevertheless, if user don't have any idea and information about their body health treatment process, so this app is useful to get suitable information about doctor and related health services.

4.1 System Design & Architecture

The nature of this project is to study and design a prototype for mobile health data collection. This follows a design and creation approach, an attempt to create things that serve human purposes; it is technology oriented. Figure 4.1 describes how communication takes place between the users and system. The user sets up the application in their Android phone. All the interactions such as calling, click body part action, comment by registering in the system, appointments are initially sent to the parse web server, these interactions are JSON service requests made by the user to store data on the parse web server. Similarly, the data is fetched from the Parse web server and then through the web server to the use. And also, location tracking service can be implemented in the application using Google

map. The web server acts as an intermediate for the interaction between the system and user for data accessible process. The user should always be connected to the internet in order to interact with the web server through the web services. Hence this way the communication takes place in the healthcare Assistant android app. Due to the busy schedule of doctors, them may or may not be available sometimes. So, this information can be updated in the web server by system admin.

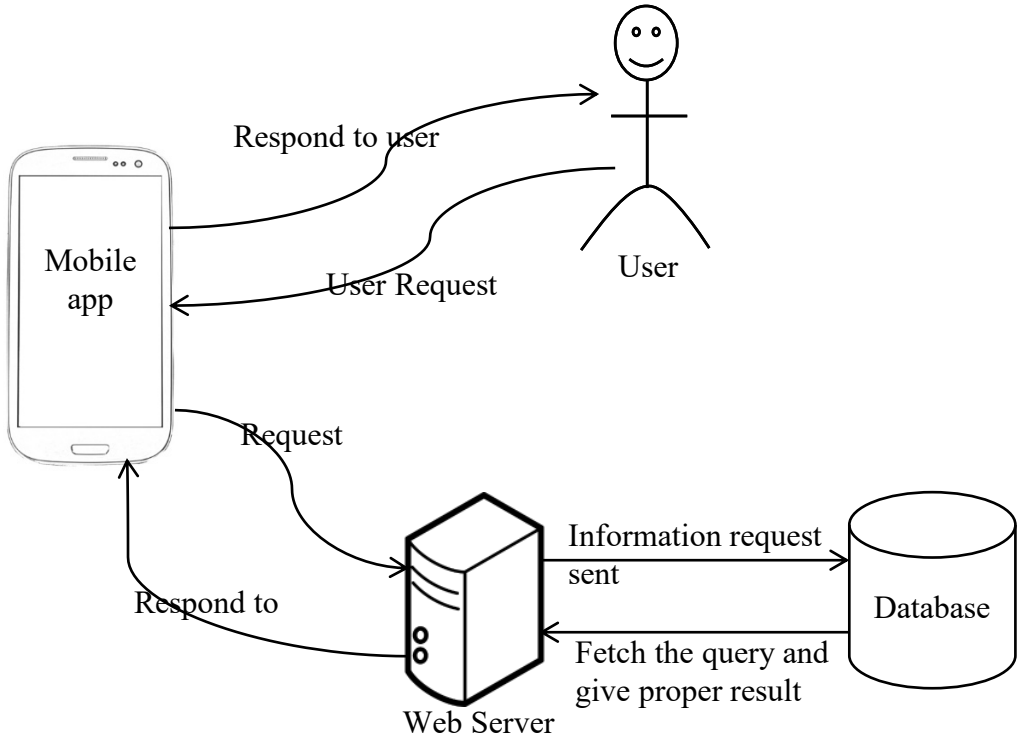

Figure 4.1: System architecture

4.2 Design and Creation

Since the application is to be developed for Android, we make necessary environment set-up and implement the application as per design.

4.2.1 Environment Set-up

- To develop an application, an Integrated Development Environment (IDE) is required. The choice selected is Android Studio IDE.

- For an Android application development, Android SDK and Android Virtual Device (Emulator) or Real Android Device are essential.
- A new android project is created to develop layouts and code the business logic for the same.
- A java project is created to implement our proposal design using android java programming language.
- To develop this application, we mainly import different google libraries (i.e. open source libraries), database connection drivers (based on SQL program)

4.2.2 Implementation

Once the necessary environment is set-up, coding is done as per design. Android layouts can be done either graphically or using XML. The required ideas or logic for the respective layout is coded using Java Class. To use any of the phone's features such as Wi-Fi, permissions are obtained by mentioning in AndroidManifest.xml file.

In addition to set information, we research and collect doctor's details of various department from different hospital located in Nepal, specially at Kathmandu, Lalitpur etc. For the implementation of doctor's details, we collect pictures, degree, medical, specialist field and their available time period during on hospital. The doctors' details and collected data are based on the official website of various hospitals. The doctor information features are implemented to the app while clicking on body part and fetch from web server such that information is recorded on database. Doctor Listing features are based on sorting mechanism such that nearest doctor's information appeared with time management from android phone. That means, user get only nearest and available time period doctor data from sorted database web server. Generally, the information includes doctor's photo, medical department, education (degree) and time period for the doctor in different hospital along with hospital name, address and phone number. (See Figure 7.3)

Various information about doctors or hospitals used in this project includes following health related organizations:

- Norvic International Hospital, Thapathali, Kathmandu [11]
- Medicare Hospital & Research Center, Chabahil, Kathmandu [12]
- Metro Kathmandu Hospital, Maharajgung, Kathmandu [13]
- Grande International Hospital, Dhapasi, Kathmandu [14]
- Annapura Neuro Hospital, Maitighar, Kathmandu [15]
- Alka Hospital (P). Ltd., Jawalakhel, Lalitpur [16]
- Bir Hospital, Mahaboudha, Kathmandu [17]
- OM Hospital and Research Center P. Ltd., Chabahil, Kathmandu [18]
- Sumeru Hospital, Dhapakhel, Lalitpur [19]

4.3 Application Module & Testing

In our development, the "Healthcare Assistant" app have different section including Male Section, Female Section and Child Section with their respective layout design that means, whole human body parts picture. The figure 7.1 shows the display format for Male Section with male human body picture in the android application.

Similarly, we design the others layouts for Female Section as well as Child Section with their body picture shown in figure 7.2. The application is tested by launching the Android Virtual Device of required version of Android. The Android emulates the application just as it would on real Android phone. Also, we tested and debugged the android APK file on real devices (Android Phone) and the output was captured with help of android screenshot function as shown in figures.

The figure 7.3 shows the click action performed when the user press/touch the body part of male/female/child, resulting into doctors and hospital information on the mobile screen. That is, the doctors list and hospital name is displayed by touching the body part. The general sample picture is taken in figure 7.3 where

user get doctor list and hospital when touch the stomach (gastroenterologist doctors) in the body part with available two clickable buttons just below each listing information.

There are two clickable buttons available in the doctor listing layout for the functionalities – calling feature and location tracking feature. The doctor data are sorted and fetch with web server to parse database to get optimal and nearest doctor details. So, this is done inside the mobile interfaces after passing user clickable action. One button i.e. “Call” is for calling the hospital number with already inputted numbers (numbers are stored inside the database). By pressing the Call button, user can directly call hospital number via android calling services which is shown in figure 7.4.

Similar way, another button “Locate” is for location track services within the mobile using google map. To use this service, user must have internet access and google map on their smartphone. That means, location or route of respective hospital address can be tracked by pressing locate button and resultant direction or path is displayed on Google Map in the mobile as shown in figure 7.5.

4.4 System Flow Diagram

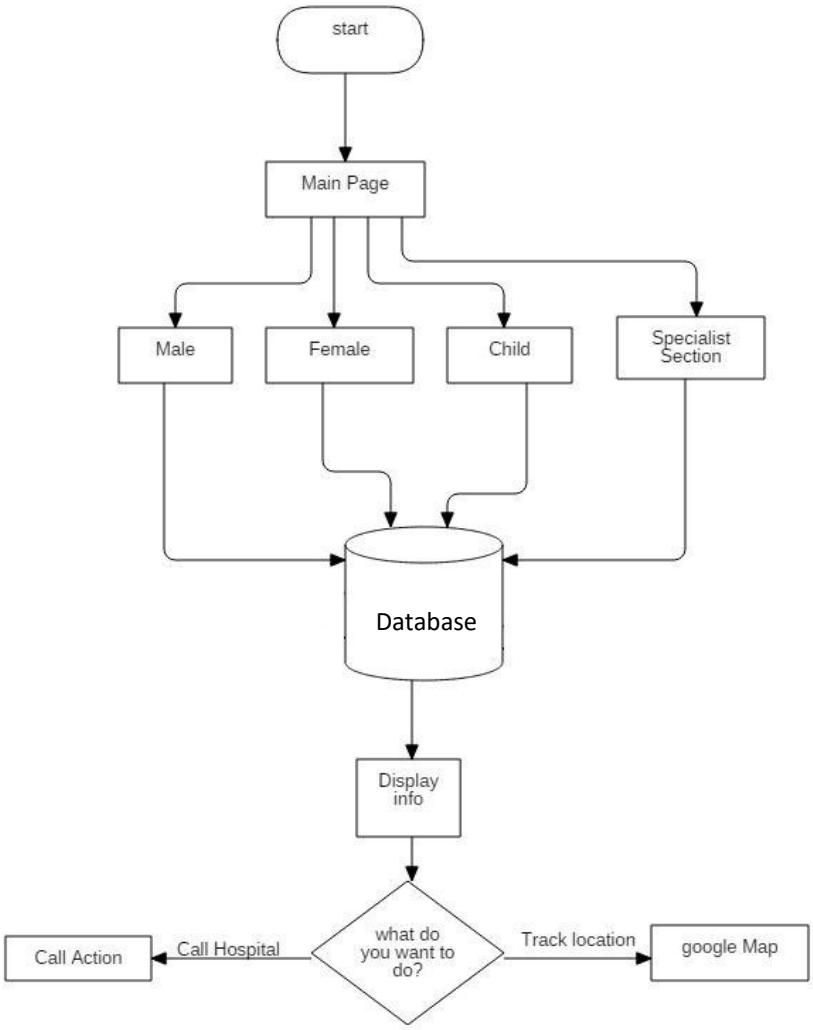

Figure 4.2: System Flow Diagram

4.5 UML Diagrams

4.5.1 Use Case Diagram

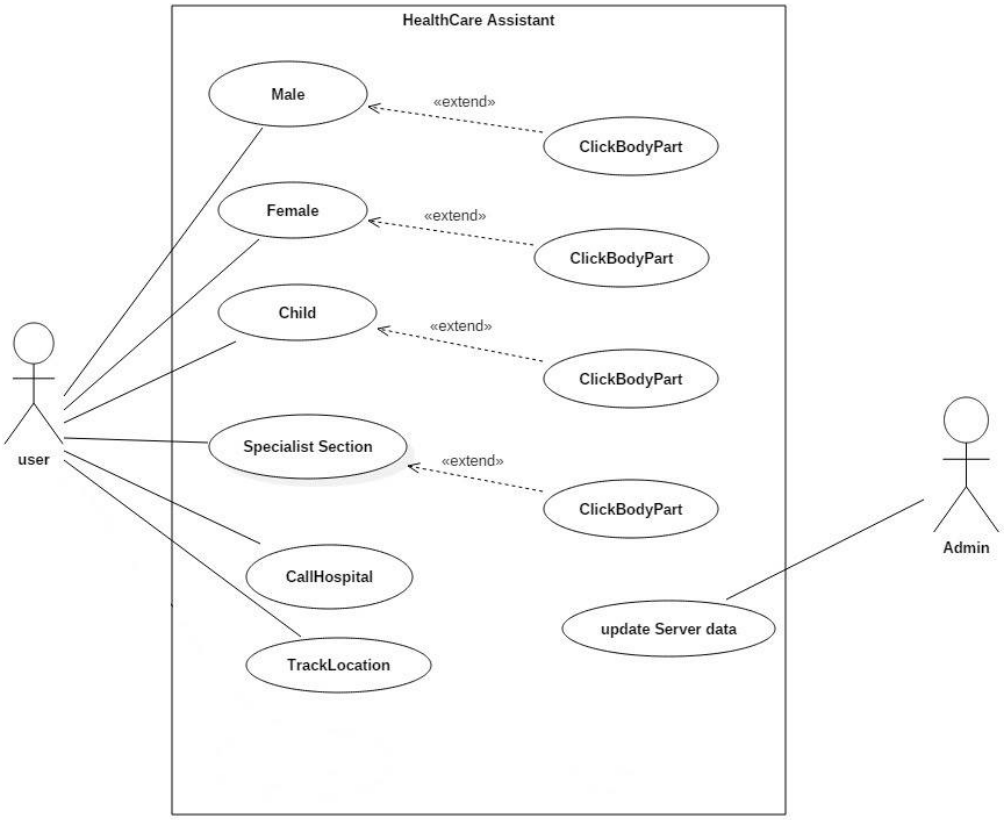

Figure 4.3: Use case diagram

4.5.2 Data Flow Diagram

4.5.2.1 DFD Level-0 Diagram

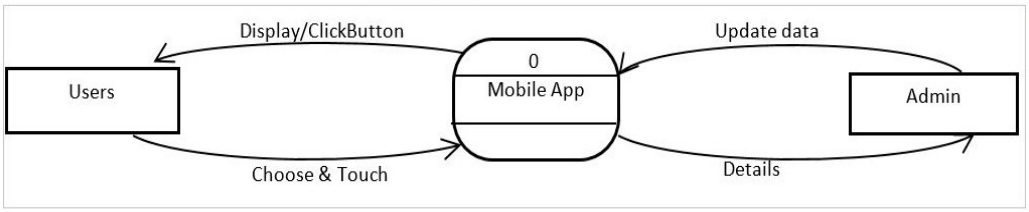

Figure 4.4: DFD Level-0 Diagram

4.5.2.2 DFD Level-1 Diagram

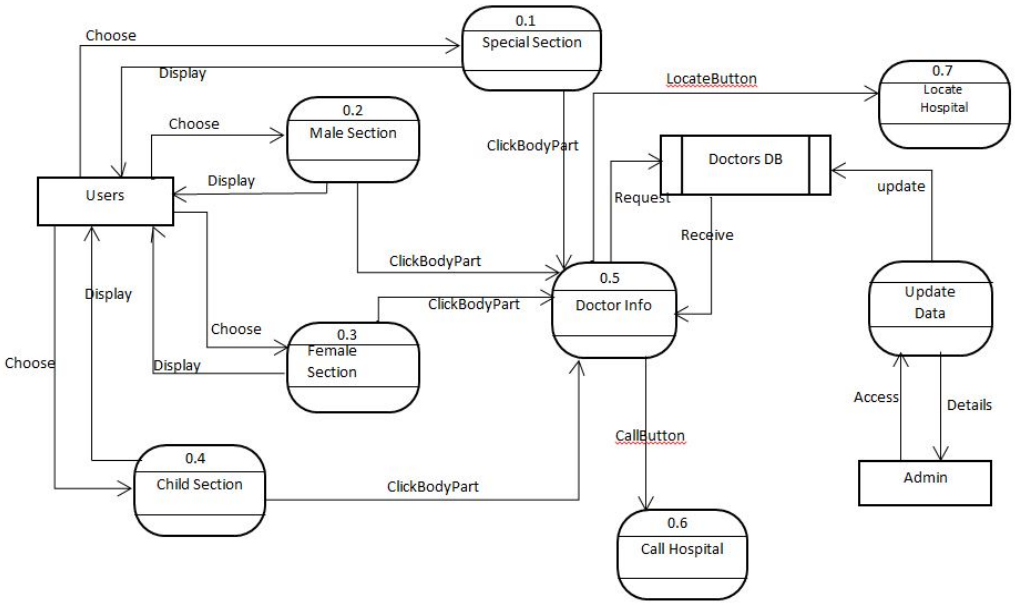

Figure 4.5: DFD Level-1 Diagram

4.5.3 Class Diagram

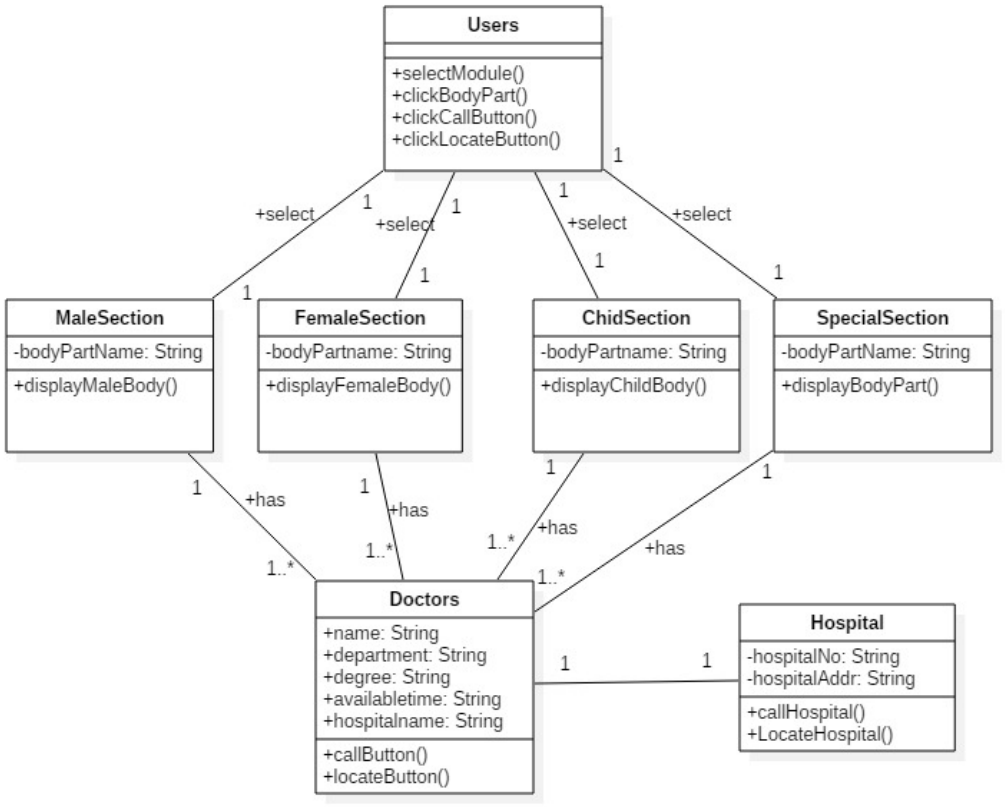

Figure 4.6: Class Diagram

4.5.4 Sequence Diagram

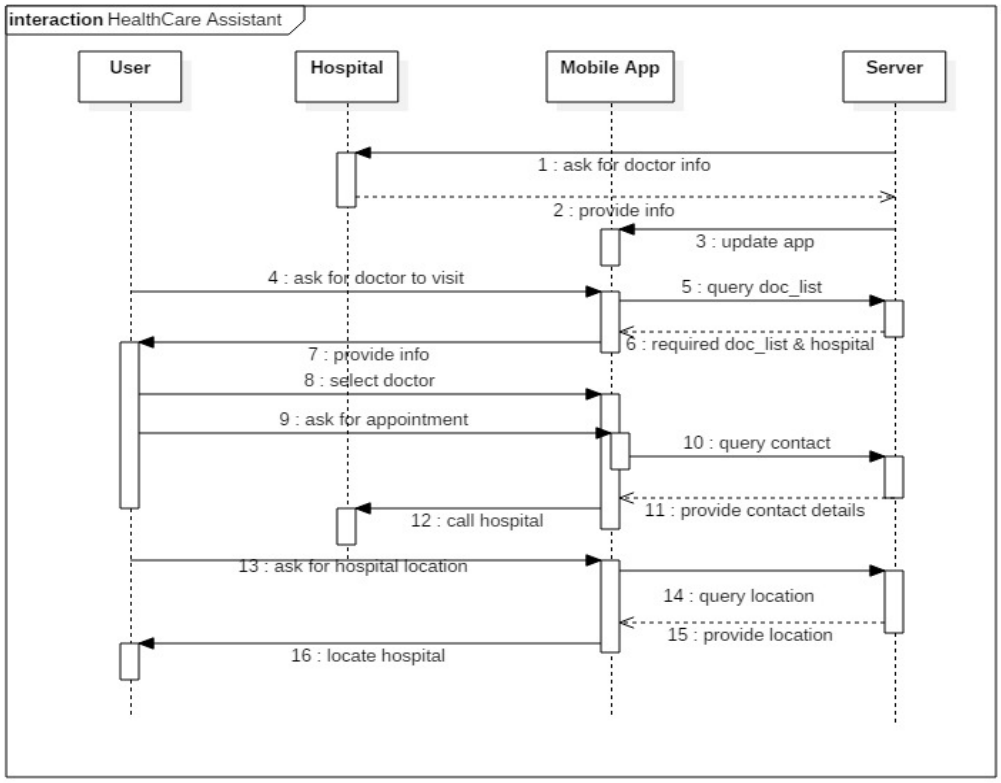

Figure 4.7: Sequence Diagram

CHAPTER 5: DISCUSSION & RESULT

5. DISCUSSION & RESULT

5.1 Discussion

The major goal of this application is to provide health information to users in proper way with mobile technology, to fulfill the basic needs/problems of the users. Users can find solution to their problem via mobile platform technology. Through the calling services users can get appointment with doctors and also, access hospital location. Healthcare Assistant serves as the platform for easy and quick communication, with extended support from doctors to patients/users. This app has various unique features by reducing the cost of customer service and providing a vital communication link between hospitals and users.

5.2 Analysis of Result

The application is deployed onto the mobile phone by using export application to Android phone (Build APK) which provides .apk file. This is uploaded to phone and is installed and run. The outputted results are shown in chapter 4.3. During Analysis of “Healthcare Assistant” application, we are installed and run on different and multiple android device and it is worked fine. During starting phase of our project, we face the little problem the collection of incomplete or incorrect data due to lack of understanding of the flow of health data or cannot get proper implementation during development. Most of the issues were fixed during debugging process and finally proper deployment of this application is carried out with different mobile. There is no any runtime error occur during installation of APK file.

In general, the application is almost fine and have well performance on real mobile devices. Basically, we tested this application on different android version such as KitKat v4, Lollipop v5 and others higher version, and it works very fast, well display, full functionalities i.e. overall performance parameters are good.

CHAPTER 6: CONCLUSION & FUTURE ENHANCEMENTS

6. CONCLUSION & FUTURE ENHANCEMENTS

6.1 Conclusion

This Healthcare Assistant simplifies the task of all, not only patients and doctor. It makes patients more relaxed as they do not have to stand in a long queue to fix their appointment and also book appointment according to their choice in a more convenient way. Doctor need not worry about managing their appointment, that is, hospital manages the appointment process of user. Your appointment gets booked from anywhere and however you want. This helps to save the time of user, patient. Many healthcare related systems have been developed on different platforms. Many of these require special hardware devices or cannot give proper environment for user to use it. So, Healthcare Assistant is made to implement a system with easily accessible and improves healthcare problems with proper environment. Through navigation system, our healthcare app provides various health solution in most every and fast ways in the recent scenario of technology. We believe one way to maximize the potential of mHealth apps to improve health is to ensure that these apps are developed to deliver health information that is simple, engaging and easy to use for people of all literacy levels.

6.2 Future Enhancements

This app can be improved in the future by adding the following functionalities:

- Medication Reminder System
- Develop separate apps for doctor and physicians
- Gathering and Adding Blood Donation Features

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APPENDICES

Figure 7.1: Male Section Module

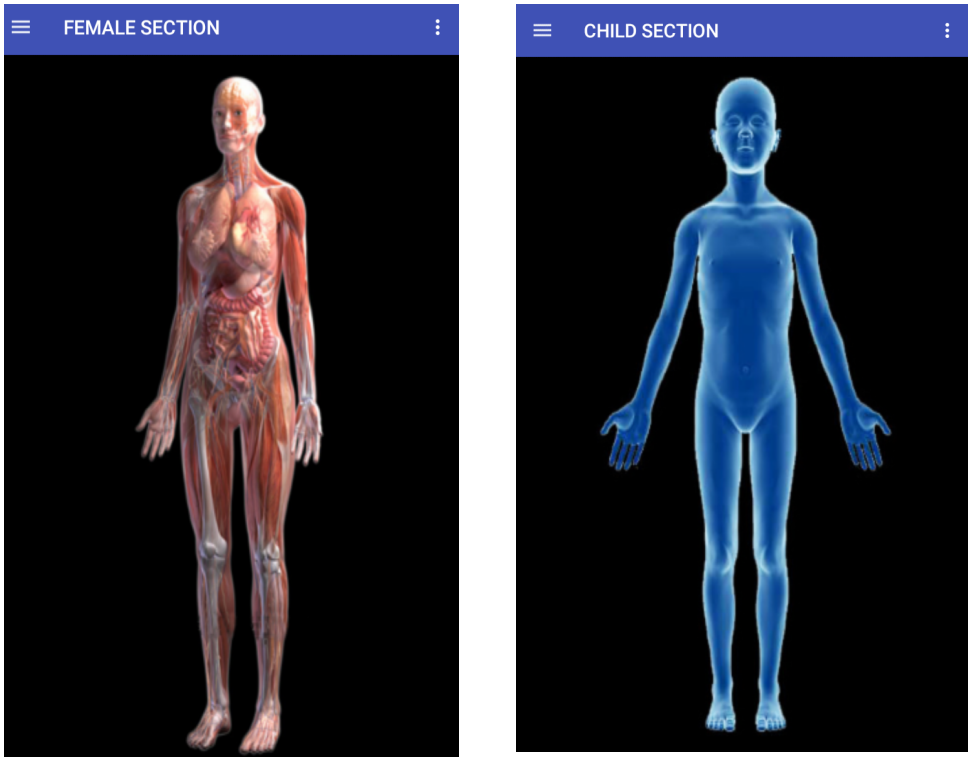

Figure 7.2: Female & Child Section Module

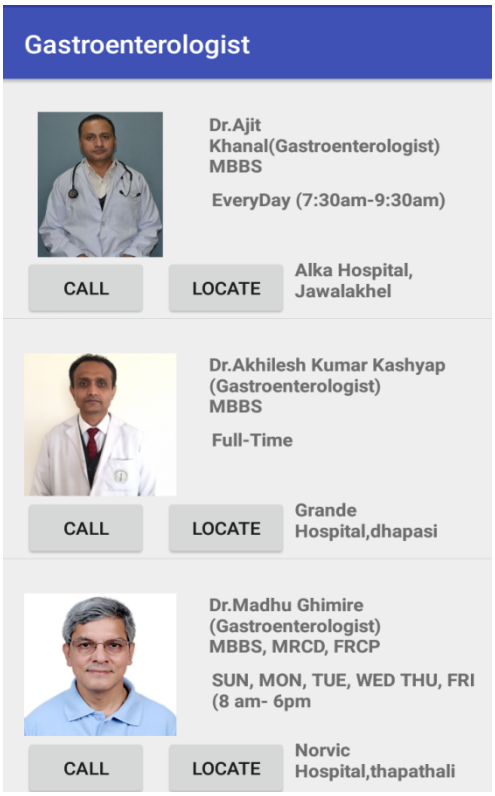

Figure 7.3: Doctor Information Module

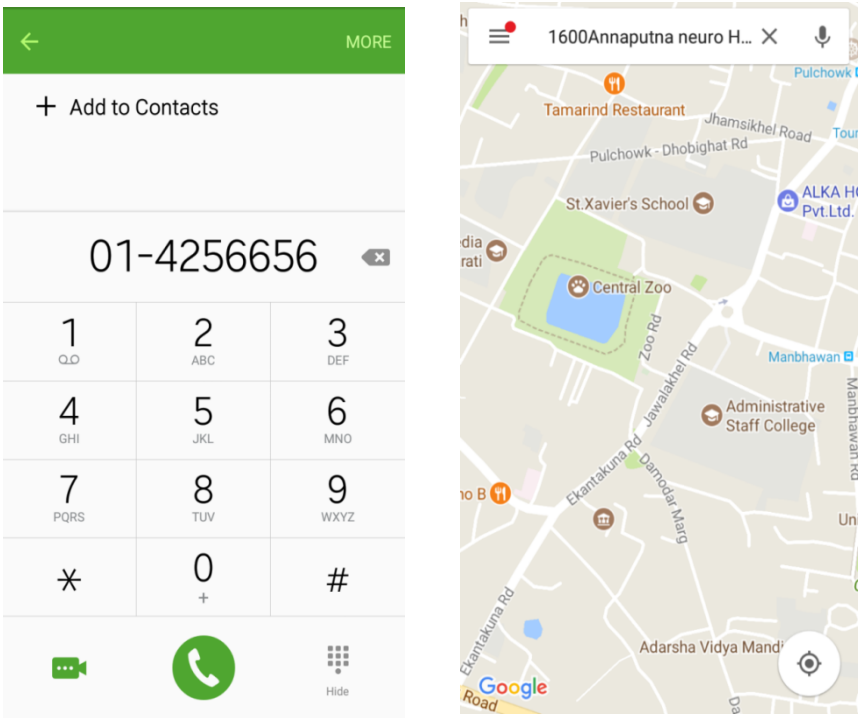

Figure 7.4: Call & Locate Action Module