

**An Android and Web based Application ‘Urban Healthcare Service’
To Improve the Health Care System of Bangladesh**

THESIS REPORT



Inspiring Excellence

Department of Computer Science and Engineering

SUPERVISOR: DR. AMITABHA CHAKRABARTY

SHAH MD MONIRUL ISLAM (17141003)

FARIA HOQUE KHAN (14101264)

MD. NAJMUS SWAQEEB (12301015)

Submitted on April 16, 2018

Declaration

This is to certify that this final thesis report of '*An Android and Web based Application 'Urban Healthcare Service' to improve the Health Care System of Bangladesh*' is submitted by the authors for the purpose of obtaining a degree in Bachelors of Science in Computer Science. We hereby declare all the work presented in this thesis paper are authentic and any inspiration of the work have been accredited with proper referencing.

Signature of Supervisor

Signature of Authors

Dr. Amitabha Chakrabarty

Shah Md. Monirul Islam

Faria Hoque Khan

Md. Najmus Swaqeeb

Acknowledgement

First and foremost, all praises to Almighty God, the most high and merciful.

Our most sincere gratitude to our thesis supervisor Dr. Amitabha Chakrabarty. Without his assistance and dedicated involvement in every step throughout the process, completing this thesis might have proved to be an impossible task.

Also, we want to thank our family, friends and well-wishers who inspired, encouraged and fully supported us through every trial that came our way, who helped us not only financially, but morally and spiritually.

Finally, we are very thankful to BRAC University, Bangladesh for giving us a chance to complete our B.Sc. degree in Computer Science.

Abstract

Traditional healthcare systems are facing challenges like lack of ubiquity, use of backdated techniques, lacks of tracking, observing and reporting status of hospitals. Nowadays, smartphones have achieved each hand and each home. Thus, individuals are making use of the mobile applications to make their regular daily existence simpler by updating in IoT, cloud computing mobile and web development and computer vision technology which offer us a wider scope in providing an active healthcare system to everyone. This paper centers on improvement of a portable application (app) to help giving a viable medicinal services framework. Using this application, individuals can get several welfares like finding hospital information in the city, information about healthcare services, suggest suitable hospitals, feedback facility, information about emergency service, searching pharmacy information, searching optical store information, getting updated live traffic, showing path to the destination in Google map. This application will be some assistance for individuals who think that it's hard to choose hospital, pharmacy, any medical store for arrangement or looking for help in crisis circumstance. Also, it will enable the majority in their regular daily existence by giving healthcare information, medical service information, emergency services etc.

Table of Contents

Chapter 1	1
Introduction.....	1
1.1 Mobile phone and web applications in healthcare.....	3
1.2 Problem Statement.....	4
1.3 Solution	4
1.4 Objectives.....	4
1.5 Thesis Outline.....	6
Chapter 2	7
Literature Review.....	7
2.1 M-Health	9
2.2 The fragments of the s-health puzzle.....	10
2.3 Smart Cities.....	10
2.4 The importance of M-Health.....	10
Chapter 3	12
Software Analysis & Design.....	12
3.1 Software Analysis.....	12
3.1.1 Feasibility of UHS.....	12
3.1.2 Requirements of UHS.....	13
3.2 Software Design	
3.2.1 Platforms for Mobile and Web.....	13
3.2.2 Third party Libraries and APIs.....	19

3.3 Database Design for UHS Main Application.....	21
3.3.1 UML Diagram of UHS.....	21
3.3.2 ER Diagram of UHS	25
3.4 UHS User Interface & Design	27
3.4.1 User Informer Application.....	27
3.4.2 UHS Main Application.....	27
Home Activity and Registration Activity.....	28
User View of Whole Process.....	29
Web Interface Design.....	31
Chapter 4.....	32
Data Collection.....	32
4.1 Methodologies.....	32
4.2 Data collection method.....	34
4.3 Existing Data Sources.....	34
4.4 Data Collection Region.....	35
4.5 Experimental Data.....	42
Chapter 5.....	43
5.1 Limitations.....	43
5.2 Future Work.....	44
5.3 Conclusion	44
References	45

Chapter 1

Introduction

In first part of the paper we have described a complete overview of our application for the readers. We have defined some applications, state a real life problem and solution by using our app. We also describe the objectives and outline of the thesis.

Internet is everywhere, thanks to extensive unfold use of computers, cheap charge of devices, heavy demand, new invention, optimization, reduction etc. Gadgets today have become so small that few years in the past television units ruled the living room. Now we will watch television in a handheld device and do plenty extra than simply looking soap operas or video games. With those new gadgets and the internet connectivity comes the concept of net of factors (IoT). IoT is a singular idea in internet which targets to connect something with all people, at any given time, using proper connection and services.

Software of IoT technology have bright future in health care systems and it's far already being utilized in specific zones. Health related information for patients is very essential. It also requires efficient and secure distribution of devices and servers (application and database servers) to render exact service to the end user. IoT related work focuses mainly on devising a network of wireless human body sensors encompassing a hospital or home environment.

For example, in Bangladesh from 1990 to 2011, under age 5 mortality reduced from 151 to 53 per 1000 labors. Mortality melts away are related with social awareness, preventive measurements, developments in socioeconomic conditions, start projects to extend scope region for vaccines, treatment of diarrhea, execution of IMCI and so on. Most vaccines are given to children aged between 0 to 10. However in many countries modern equipment's are limited to local health centers and is regularly extremely far away. Health workers in developing countries setup facilities in local zones utilize backdated methods to determine and handle issues. Workers normally investigate fever by putting their hand on a child's brows. They measure heart rate operating stop watch. To give enhanced medicinal services, updated and advanced activities are required. Starting

at 2015, UN's sustainable development goal number 3 is, to guarantee "Great health and wellbeing" of the general population [1].

Now-a-days, smartphones have been one of the examples of overcoming adversity of the most recent decades. In a moderately brief timeframe, smart portable innovation has penetrated fundamentally into society, catching an entire age range of followers in western industrialized countries, from school children to senior residents. Such advance has based upon a long history of the utilization of specialized gadgets, and a fast selection of mobile communication. Devices that began in the latter part of the last century. Many older people also use smartphones all the time, to maintain contact with inaccessible relatives and companions, and to chat every day, helped by call costs being by and large separation autonomous. In any case, the smart phone can undoubtedly be seen as significantly more than a basic specialized gadget. It applies a broad impact in the public field, since in actuality, the smartphone has empowered us to end up 'conveyed creatures', due to the way that multipurpose correspondence has free us from our geographical roundedness. Smartphones show up thusly to be at the vanguard of a social move where clients are encouraged to always search out new data and make associations with progressively scattered media content. While the statistic insights may shift from nation to nation, the smartphone is a wonder that is here to stay and one which will quickly advance in its development in the years to come. There is therefore great scope to harness the potential of mobile telephony to improve many aspects of society, including healthcare [1].

On smartphones

Despite the fact that the smartphone has been broadly utilized for a very long while, smartphones are a more recent progress. They are smartphones that offer not just the standard offices for example, voice and content correspondence, but also advanced computing and communication capacity, including, for instance, Internet get to and geo-situating frameworks. In contrast with prior smartphones, smartphones for the most part additionally have bigger, higher determination show screens. Most of the newer generation of smartphones also incorporate other features such as on-board personal management tools, high quality cameras and recording devices. Some smartphones, for example, the Blackberry, additionally join little inward consoles in their plans. As of late, Apple's iPhone and Google's Android touch screen gadgets have expanded smartphone proprietorship. They are well known in view of their natural and material graphical UIs and

characteristic motion control. The most recent age of smartphones are progressively seen as handheld PCs instead of as telephones, due to their capable on-board figuring ability, vast recollections, huge screens and open working frameworks that support application improvement. The potential for the production of basic and simple to download applications for smartphones has made a lively new industry. There is presently an application for pretty much every social, amusement furthermore, instructive prerequisite [2].

Smartphones have now accomplished such an inescapable nearness in the public eye that clients find it simple to self-sort out themselves crosswise over vast topographical zones. Numerous have embraced a culture where they are 'constantly associated' to their companion gatherings, groups of training and data. The Smartphone gives a fundamental 'whenever, wherever' entryway into the whole internet of information. Such nonstop and inescapable social availability has critical ramifications for society, and holds a great deal of potential specifically for use in instruction, health services and medication.

1.1 Mobile phone and web applications in healthcare

Obviously the potential for portable correspondence to change social insurance and clinical intercession in the community is huge. A few past examinations have assessed the utilization of smartphones or through website to help social insurance and general wellbeing mediations, quite in the gathering and examination of information for health services explore and as utilized as a part of help of restorative and health services instruction and clinical practice in the community. A few investigations have featured the fruitful utilization of smartphones or website to strengthen telemedicine and remote healthcare in developing countries with information support for searching healthcare services [3].

In our work, we propose a bundled and generic system where devices are connected to one tiny and affordable computer either by cable or wireless technology. The proposed system contains a unit that can be transported through land, rivers, lakes and seas. We administer all the searching data of hospitals and all other healthcare services and present these data by creating mobile and web applications.

1.2 Problem Statement

Road traffic accidents are the world's number one cause of death among young people. Bangladesh has one of the highest death rate in road accidents in the world. Moreover, Dhaka, the capital of Bangladesh, is the most vulnerable city both in terms of total number of accidents and accident rates. And most of the case some people are lost their lives for the lacking of best medical services. According to the news of Prothom Alo (2016), a patient whose name was Shanto Sarkar, a student of CSE Department of BRAC University, was injured in a road accident. It was an emergency case. But for the shortage of ICU seats he could not get proper treatment. By knowing nothing about the emergency facilities in the hospitals, his relatives took him one hospital to another one for the treatment. For this kind of lacking of medical services, he had to lose his life.

1.3 Solution

Keeping patients informed and engaged is very important for maintaining a strong relationship. This goal also plays an important to ensure quality and transparency across engagements with multiple doctors and institutional departments. If the mobile app or service in question isn't capable of delivering this data to patients and other users on the opposite side of this interaction, then it's virtually impossible to provide quality healthcare services from a mobile view. If we have a mobile app for health care, then we don't need to face this kind of situation again. By using this app, people will be able to get a proper suggestion for any kind of medical problem, to find the best medical store on cheapest costs which is so helpful for the poor people, to get a transport service for the patient.

1.4 Objectives

The part of current innovation is yet to be changed completely in advancing health management in many parts of the world. Management of data relating to restorative hospital and healthcare service as well as executive of e-health continuous to be a headache since paper-based outlines are still used today, particularly in hard-to reach rural areas. For example, there had been a few endeavors in nations like India, Malawi and Bangladesh to use SMS as a location information for healthcare services. Keeping up forms like these are hard, requires double entry and are disposed to human errors. Besides, the information is unoriginal. However, a system that is prepared to do

naturally translating and transmitting customized estimation information to the servers at runtime would deal with these inconveniences.

We feature that our system be joined with other arms of an admin. In our country, most of the individuals have smartphone number to distinguish themselves. Since our system is convenient, we can move it over each side of a nation which will help us to collect the information of all healthcare centers. Our point here is to screen the development, updating ambulance availability, uploading information to the main server, updating all the available healthcare facilities, display paths to ambulance drivers for receiving patients, display information to partners and give choices to the partners etc. Features of our system are as follows:

- Door to door delivery of improved health services, upgrading correctness and giving elegant quality of diagnostics through automatic review, record maintenance, recognizing instances of healthcare services.
- Increasing existing healthcare services by making isolated system framework and software to keep up customized and altered healthcare service related information to secure best use of healthcare service.
- Adjust healthcare system with existing registration systems of an individual, such as Email ID, Phone number, all other personal information, security number. Thus we can relate a partner with their needs of healthcare services or centers using their phone number or email address.
- We can store locational information relating to emergency patient, suggest best healthcare service nearby with best facilities.
- Preserve information about the hospitals, pharmacy and optical stores which we need. We can also store the level of information relating to emergency services, nearby pharmacy, diagnostic centers, optical stores and so on.
- Distribute the healthcare services to different areas in the country. Policy makers can see the service distribution area at a particular moment. For example, they can view demographic report of a particular country about how much area is available with healthcare services and how much user are using this application.

- Users can see the live update of traffic. It helps us to follow the route which one is better to go. It's a time consuming process for any emergency situation.
- Users can rate the qualities of hospitals and diagnostic centers with proper feedback. It will be helpful for the other users to choose the best one.

1.5 Thesis Outline

Chapter 1: Introduction, Mobile phone and web applications in healthcare, Problem Statement, Solution, Objectives of the proposed system.

Chapter 2: Literature review, M-health, The fragments of the s-health puzzle, Smart cities, The importance of M-Health.

Chapter 3: Software analysis, Software design, Database Design, UHS User Interface & Design.

Chapter 4: Methodologies, Data collection methods, Existing data sources, Experimental data.

Chapter 5: Limitations, Future goals, Conclusion.

Chapter 2

Literature Review

According to the research in last few years, the most collective uses of mobile phone in healthcare is mixture of sensor technology, like home based patient monitoring devices, and web-based programs etc. The whole system implementation is designed into three functional layers such as: identifying, communication and management. Identifying layer implements a mobile monitoring for health data, signal processing and data analysis. Communication layer contains short range wireless connection via Bluetooth or different technologies for short range communication and worldwide wireless connection via a mobile phone. Management layer carries out data processing and management tasks, mostly through internet. Researchers have proposed several systems based on the above three layers [4].

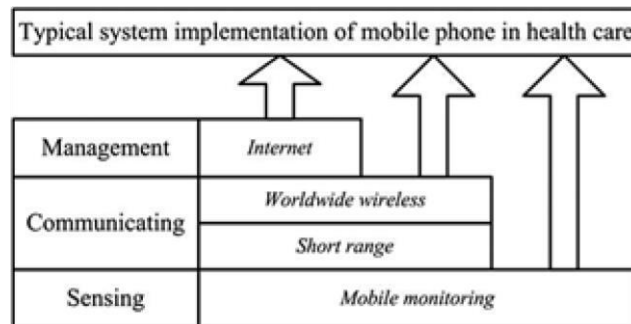


Figure 1: Typical System implementation of mobile phone in health care

Some reporters suggest that the natural advancement for healthcare is to go mobile, because it is information concentrated and smartphones can offer an appropriate solution. Smartphones are useful to keep clinicians up to date with the latest medical techniques, and it is easy and cost effective to communicate updates, advice and guidelines to a distributed community of exercise in this way. As has also been demonstrated, mobile phones are useful for monitoring and diagnosing

health conditions when clinicians are a distance from their patients. Additionally, with the Internet playing a collective role in medical education, it is likely that for roaming health workers the most important entree gateway to this information will be handheld devices such as smartphones. Indeed, Georgetown Medical School in the USA, for example, is now demanding every medical student to have an iPhone, and surgeons are finding the most important access portal to this information will be handheld devices such as smartphones. Indeed, Georgetown Medical School in the USA, for example, is now requiring every medical student to have an iPhone, and surgeons are finding the device (and its apps) very useful in improving their diagnostic skills and education. Smartphones are therefore useful to the medical and health related professions because they are agile, handheld, easy to use and can be used on the move.

A mobile phone united with physiological function detector was disclosed by Shen. Now a days, there is a system which encompasses a physiological function signal receivable mobile phone, a measurer used to teach on the human skin and transmit detection signals to the mobile phone by wire or wireless transmission method. The mobile phone can confirm measured data in its display for reminding a user of his health conditions [5].

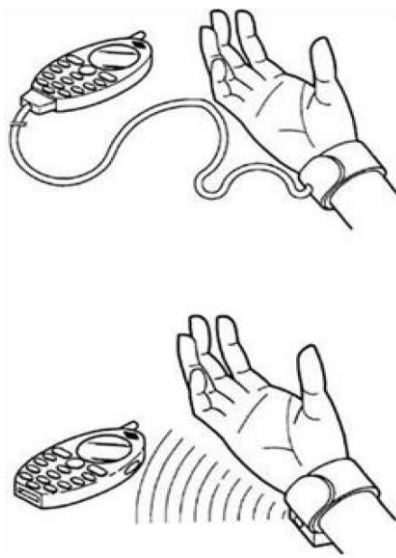


Figure 2: signal transmission of the measurer in different ways

Apodaca and Peralta presented an apparatus that adjoins a cellular phone with medical monitoring devices, like blood glucose monitoring etc. The creation is able of clearly alerting the user of abnormal test results. In addition, for monitoring and managing chronic diseases, it can store

multiple test results for analysis. Moreover, the apparatus is able of transmitting test results to healthcare providers and when highly abnormal results are received to emergency responders. So, the rapid adoption of effective mobile computing gadgets raises the innovation of new preventive medicinal services opportunity. Computing devices capable of gathering and handling sensor information obtained by wearable sensors and advising a user by using sound or display panel. For example, cell phones, individual computerized associates, watches and so forth are developing. In addition, these devices are getting to be littler, lighter and more affordable. These devices are conveyed about wherever by an expanding level of population and in this way can be utilized to convey day by day health information [5].

Generally, the above developments mainly contain four modules: a user administration module, managing user information, a data analysis module, investigating user's health condition in view of the user data and health data put away in the memory and received from sensors and creating analyzed result. So, it will be helpful if we use these computing devices to search all healthcare services nearby. As a result, a new comer can find out all locations for taking all facilities of healthcare easily.

2.1 M-Health

The implementation of information and communication technologies (ICT) within the healthcare area controlled the concept of electronic health (e-health), which is causative to reduced costs and Enlarged efficiency. Resulting the alliance of e-health, the generalized use of mobile devices with positioning capabilities (e.g., smartphones) opened the door to the idea of mobile health (m-health), which could be understood as the distribution of healthcare services via mobile communication devices. M-Health has unexpected potential then it adds to the advantages of e-health all the benefits related to the ubiquity of mobile devices (i.e., global monitoring abilities, Wide availability, and nearness). Although significant developments have been made, m-health

Still in its early stages and is developing in parallel to another very talented concept: smart cities, which are also founded on ICT and aim to challenge local problems, from local economy and transportation to quality of life and e-governance [6].

Local governments are investing in ICT to provide their urban areas with mechanical frameworks ready to help ambient intelligence, and encourage social obligation and regard for the condition.

In this sense, the open doors for smart cities are limitless, and organizations are taking a move to unite their leadership in this area. They have distinguished a few vital regions in which smart cities will perform a key role: public safety, energy and utilities, financial improvement, education, social administrations, and medicinal services, among others.

Smart cities are firmly based on sensors that give refreshed data about diverse variables, counting temperature, humidity, allergens fixation, pollution, movement conditions, and location searching and so on. As indicated by Chen and Kotz, the unique circumstance could be characterized as "the ecological states and settings that either decide an application's conduct or then again in which an application occasion happens and is interesting to the user." We understand these factors, given by the smart city foundation, as the context that encourages us to comprehend the living condition of a resident whenever. In this way, by proper utilizing this data, we can give natives and patients with healthcare applications and services with dynamic context awareness (i.e., applications and context that consequently adjust to found context) by changing the application's and service's' conduct.

2.2 The fragments of the s-health puzzle

S-Health is a natural complement to the idea of m-health inside the context of smart cities that provide an extraordinarily rich context aware condition. Because of this fact that s-health is a new idea, we can barely investigate the state of the art. However, we equip the reader with a short review of the fundamental research regions related to it.

2.3 Smart Cities

The idea of the smart city has not been entirely characterized and can still be considered an indefinite idea. According to the idea of Caragliu in and extended in Pérez-Martinez Et al., Smart cities are urban area firmly established on data and communication skills that put resources into human and social funding to enhance the personal satisfaction of their citizens by cultivating financial development, participator administration, smart management of assets, supportability, proficient portability, while they ensure the protection and security of the citizens [7].

2.4 The importance of M-Health:

M-Health application is the abbreviation of mobile health. It is the application of portable innovation and the remote devices to enhance the performance of health and health care. We all

use our mobile phones daily so the health care and technology both get unite together then it will be easy to use the health app. In past If we were having fever or frosty then we overlook it and take solutions from medicinal store and feel better but it is not good every time. These little illness turns into a major issue for us and its risky so this application of medicinal services is anything but difficult to seek clinics or some other healthcare centers close-by for diagnosing our infections. It gives us the emergency supplies and specialists to get appropriate treatment within a brief timeframe [8].

At some point in the event that we are having some dangerous sickness then we can't trust on the reports of one specialist so we attempt to contact with no less than one more specialist. This application causes us to contact with at least one specialist from some other healing facilities. This app helps us to contact with one or more doctor from any other hospital. But we don't know the location of that hospital. At that time, we can use this app to find out the location of the hospital which we suppose to find. We just have to follow some protocols safely and carefully.

Chapter 3

Software Analysis & Design

Here we discuss about the feasibility analysis of software, how we have designed the Database of UHS software and importantly interface design of our main application.

3.1 Software analysis

3.1.1 Feasibility Analysis:

Technological feasibility: The application we have created is anything but difficult to operate. It was worked in a way that it meets the user's usual range of familiarity. The present users of smart phone application over the globe in the case of operating a route application or contract an auto application operate an interface very like our own subsequently making it conceivable to achieve each user combine. There is sufficient programming segments used as a part of the backend to give a strong support of the user.

Economic Feasibility: As a Health Service Application we had to make zero investment for now thus making it economic. And in the long run process with more features added like premium services like live update of ICU, cabin booking service, live update of ambulance service. If we look carefully, we will notice that for maximum number of users, using our application even collaboration with hospitals and other health service providers may cost effective [9].

Organizational Feasibility: Health care service is quite a major problem in the world right now mostly in Bangladesh, to reduce this problem our application can help the users in many way. If we imagine a short scenario around our cities in Bangladesh we would definitely see a major change. This insures the organizational feasibility of this app.

3.1.2 Requirements of UHS:

Functional Requirements:

- We are constructing an android application and website, so user need an android based OS (Operating System) and any device compatible to using internet.
- Internet is mandatory for updated information of all healthcare services.
- The app needs user authentication for rating the hospital and diagnostic center.
- The app needs real time database, so it requires real time database and cloud system.

Non-functional Requirements:

- Huge number of users may search the data at the same time so application should able to handle the traffic.
- The application should be user friendly.
- It's an emergency application for crucial time. So the application when crashed will generate negative perception about the application. Therefore, every time when the application crashes, a crash report processing is necessary.

3.2 Software Design

3.2.1 Platforms for Mobile and Web:

Health care is an essential need of each person. In Bangladesh, the healthcare system is fundamentally given by the government with next to zero charge. But this comes with numerous difficulties. The enormous number of patients makes it troublesome for the government hospitals to give them a quality medicinal services. As a result, thousands of private hospitals are established with a view to meet the growing need of the masses for a quality health care. In any case, when one wish to take benefit from a hospital, he first tries to gather information about that hospital. This information is not only hard to find but also difficult to understand in some cases. Particularly

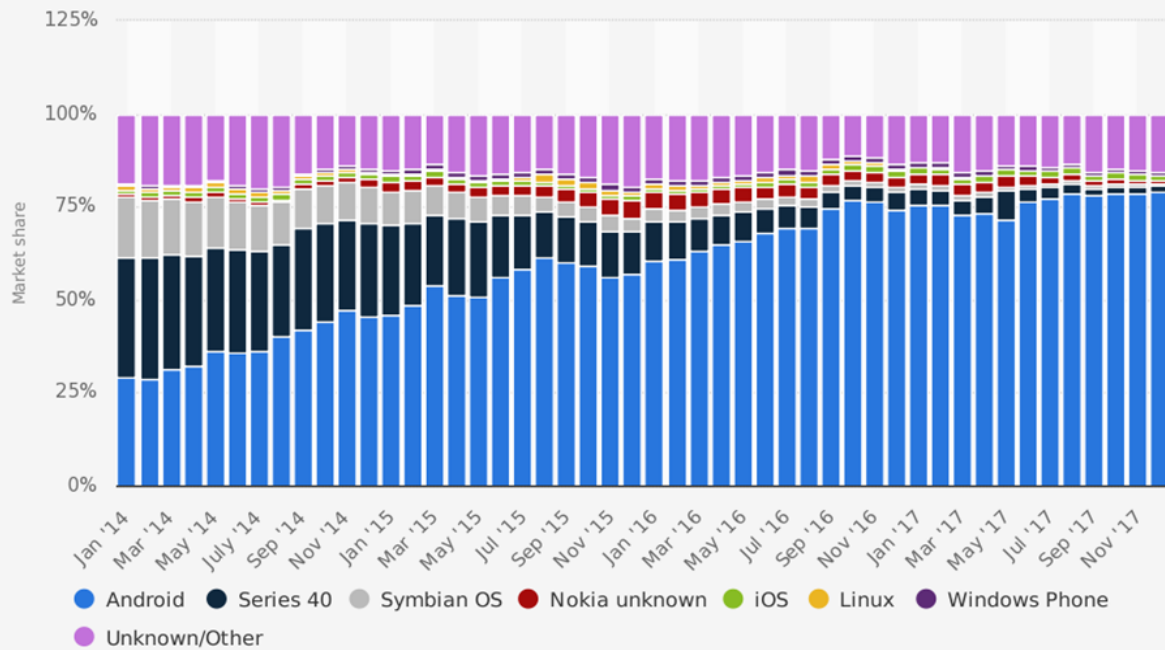
when individuals from provincial territories come to urban zones for better healthcare services, they think that it's exceptionally hard to pick a suitable hospital with better facilities. Additionally, when looking at a number of hospitals for discovering better options, it represents a few complexities. The cost and quality for different services in a hospital can be used as a metric for comparison with other hospitals which is not generally conceivable.

Though people are making use of the beneficial mobile applications to make their everyday life easier, we are trying to give them effective healthcare service by going through various survey to select what will be the best and most usable smartphone OS.

As more advanced cellphones use to develop in Bangladesh, its opportunity to create venture flexible application for both b2b and b2c administrations must to coordinate their application in smartphone.

According to the report of January 2014 to December 2017, the measurement demonstrates the piece of the overall industry of useful working bases in Bangladesh. In December 2017, Android held an offer of 79.21 percent of the portable working framework showcase in Bangladesh [10].

Market share of mobile operating systems in Bangladesh from January 2014 to December 2017*



Source
StatCounter
© Statista 2018

Additional Information:
Bangladesh; StatCounter; 2014 to 2017

statista

Figure 3: Satirical data of most usable Smartphone OS in Bangladesh [10]

From various report we have decided to use android application and web version of Urban Healthcare Service to develop the health sector. A mobile application to create health care more suitable for the crowds is proposed. In Bangladesh, the main reason to choose android platform is that the cost of android phone is reasonable and even poor people can manage to pay for having one. Besides, android phones are seen widespread and all ages and class of people are using it without trouble.

Android:

Android is a product stack for smartphones that integrates an operational structure in light of the Linux Kernel, middleware and key applications. At a bigger scale, Android is an Ecosystem worked by Google and its members, which empowers Android engineers to manufacture, convey and adapt applications for a scope of touchscreen Android gadgets. Although touchscreen gadgets,

Google has additionally created Android TV for TVs, Android Auto for autos, and Android Wear for wristwatches, each with a particular UI. Variations of Android are also used on amusement supports, advanced cameras, PCs and different hardware. In Bangladesh almost 80% Smartphone clients are utilizing Android OS. This operating system is based on version 2.6 of Linux, so it has a monolithic system kernel, what means that all system functions and drivers are grouped into one block of code [11].

Architecture:

Android comprises of five layers:

- The Linux bit 2.6-which integrates helpful drivers to use Wi-Fi or Bluetooth of the smartphone.
- The library written in C and C + that give higher amount usefulness. For example, a HTML motor, or a database (SQLite).
- A runtime domain for applications in light of a virtual machine, made for wasteful machines, for example, phones. The point is to translate JAVA in machine language comprehended by Android.
- A JAVA structure that permits applications which is running on the virtual machine to compose and participate

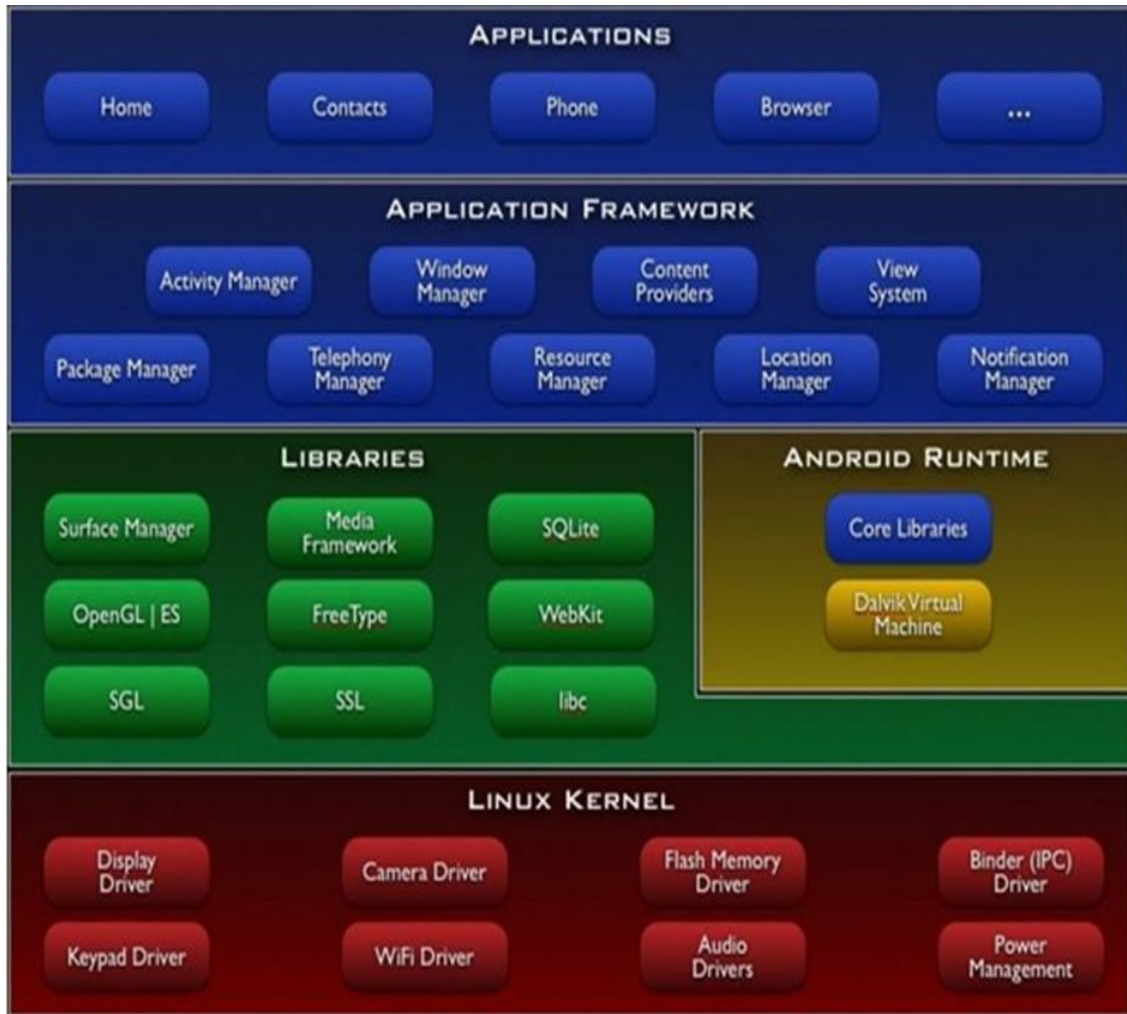


Figure 4: Architecture of Android OS

Programming language: JAVA

Java is the most broadly used programming language by the android developers. Android was initially developed by James Gosling at Sun Microsystems on 1995 which is now received by Oracle Corporation. One of the fundamental reasons of utilizing Java for android development is- the language's platform has independent quality. As it runs on many different hardware platforms. So utilizing any stage secondary language will lead you to integrate and advance your local code for every one of these individual stages to recognize any genuine advantages. Other than Java has enormous open source support, with numerous libraries and instruments accessible to make engineers life less demanding. Java additionally protects designers from huge numbers of the

issues natural in local code, similar to memory releases, terrible pointer utilization, and so on. Java permits making sandbox applications and making a superior security show so one terrible App can't bring down your whole OS. There are countless effectively capable in Java which is one of the key reasons of utilizing Java in creating android applications. Finally as we are learning JAVA from the very first semester of our undergrad life it is very familiar to us [12].

Android Studio:

Android Studio is the official integrated development environment (IDE) for Google's Android operating system, built based on Jet Brains' Intel IJ IDEA software and designed specifically for Android development. It is available for download on Windows, macOS and Linux based operating systems. It is a replacement for the Eclipse Android Development Tools (ADT) as primary IDE for native Android application development. We have used the current android studio version v3.0.1 for this UHS user & informer app because it includes certain useful updates like the two new Constraint Layout Features, the different catch to push changes with Instant Run, would now be able to change over PNG, BMP, JPG, and static GIF documents to Web design. Web record organize which gives lustrous pressure (like JPEG) and straight forwardness (like PNG) however can give preferable pressure over either JPEG or PNG [13].

Android SDK:

The Android software development kit (SDK) includes an exhaustive arrangement of advancement devices. These unite a debugger, libraries and a handset emulator in view of QEMU, documentation, test code, and instructional exercises. Presently upheld improvement stages incorporate PCs running Linux (any cutting edge work area Linux appropriation), Mac OS X 10.5.8 or later, and Windows 7 or later. For this undertaking we have utilized SDK variant v2.9.0 [13].

Developer Console:

The Google Developer Console empowers engineers to send their applications to the Google Play Store and track utilization and other related investigation.

3.2.2 Third Party Libraries and API's:

Google Maps Android API

With the Google Maps Android API, one can include maps based Google Maps information to their application. The API naturally handles access to Google Maps servers, information downloading, outline, and reaction to delineate. One can likewise utilize API calls to include markers, polygons, and overlays to an essential guide, and to change the client's perspective of a specific guide zone. These articles give extra data to delineate, and permit client communication with the guide. The API permits to add these designs to a guide:

- Icons moored to particular positions on the guide (Markers).
- Sets of line fragments (Polylines).
- Enclosed fragments (Polygons).
- Bitmap designs moored to particular positions on the guide (Ground Overlays).

We have used the API for displaying user's current location as well as the location of health care service provider .It will detect the locations of users show them the nearby locations of health care service provider.[14]

Google Maps Direction API

The Google Maps Directions API is an administration that figures headings between areas. One can scan for headings for a few methods of transportation, including travel, driving, strolling, or cycling. The API returns multi-part bearings utilizing a progression of waypoints. Determines inceptions, goals, and waypoints as content strings or as scope/longitude facilitates, or as place IDs. The API restores the most productive courses while computing bearings. Travel time is the essential factor enhanced, yet the API may likewise consider different factors, for example,

remove, number of turns and numerous increasingly when choosing which option is the most productive.

Subsequently by considering all the previously mentioned highlights of this API we have coordinated it in our application in order find the nearest hospital information about all the healthcare service provider for the user from their current location.

Android Design Support Library

Material Design is another plan dialect that gives outline rules for Android applications, was presented with the arrival of Android 5.0 Lollipop. With it came new UI parts, for example, the 'Gliding Action Button', 'Typography' which includes facilitate direction style and line tallness for thick and tall dialects, 'Cards' which incorporates more specs for laying out activities and substance and so forth. We have utilized variant 25.3.1 of the android bolster outline library rather than the most recent adaptation 26.0.1 because of similarity issues with our different libraries [14].

Retrofit

Retrofit is a REST Client for Android and Java by Square. It makes it moderately simple to recover and transfer JSON (or other organized information) by means of a REST based web benefit. In Retrofit we design which converter is utilized for the information serialization. Ordinarily for JSON you utilize GSON, yet you can add custom converters to process XML or different conventions. Retrofit utilizes the OkHttp library for HTTP asks. To work with Retrofit you require essentially three classes [13].

- o Model class which is utilized to delineate JSON information to
- o Interfaces which characterizes the conceivable HTTP tasks
- o Retrofit. Builder class - Instance which utilizes the interface and the Builder API which permits characterizing the URL endpoint for the HTTP task For this UHS app we have used retrofit version 2.3.0

3.3 Database Design

For our android app, we needed to learn a new thing like- how we use databases in Android. We can use databases for JEE, but in android, it is different. In fact, there are convenient functions to manipulate SQLite which is the database built into android. In this part of the report, we first think to use firebase as Firebase provides a real-time database and backend as a service but it was complicated to use this. And there are some reason behind that we got some data from "International Centre for Diarrheal Disease Research, Bangladesh" about the locations of healthcare service provider .We extract their data and found that database is too much complicated. So, therefore we need to make a custom API for server side. As it was complicated to write that on Firebase so shifted that on our own server. Then we implement the own made custom API on that server.

3.3.1 UML Diagram OF UHS

We have drawn some UML diagram for the Application. For example, we have drawn some use case diagram for the system which is given below.

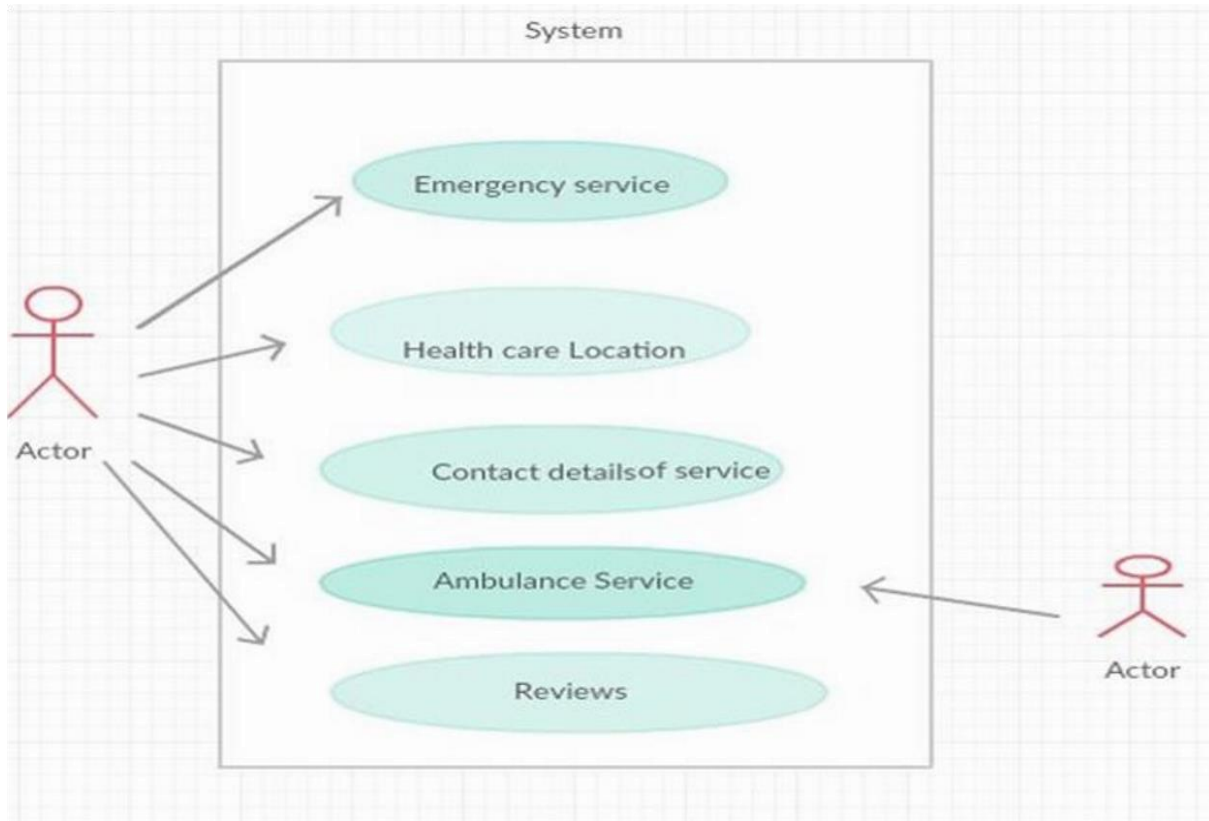


Figure 05: Use Case Diagram for UHS

In the above use case diagram, we have shown some activity of the app. Like- user can be registered or unregistered. Authentication will be done by the system admin. .Customer will search the hospitals or diagnostic centers which will be shown by the map. So, it will be used like a direction path.

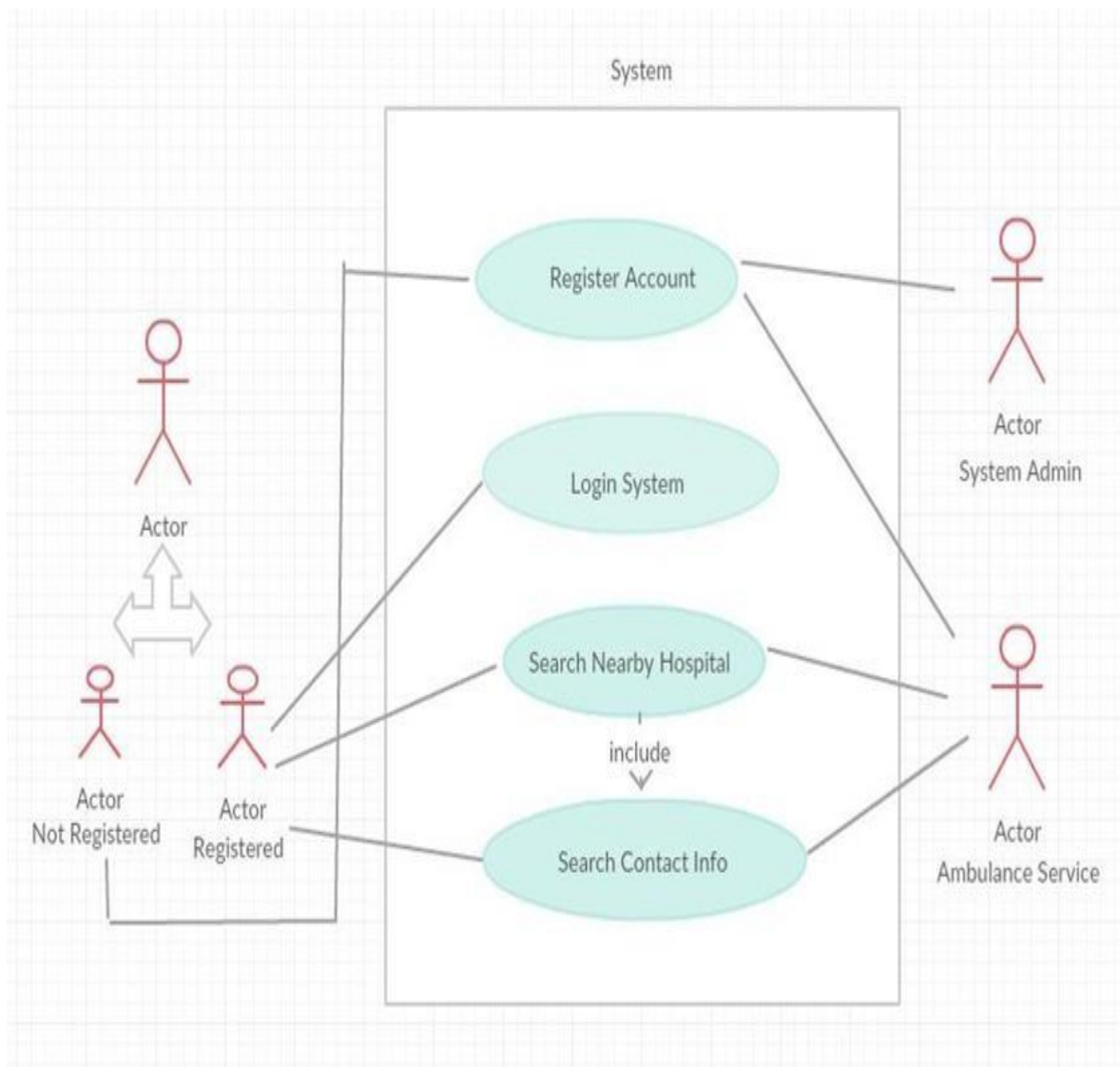


Figure 06: Use Case diagram for Hospital

In the above use case diagram we have shown the diagram for the specific hospital searching process. User will enter into the application and search for the hospital. Hospital will include the Contact information and all the facilities of the hospital.

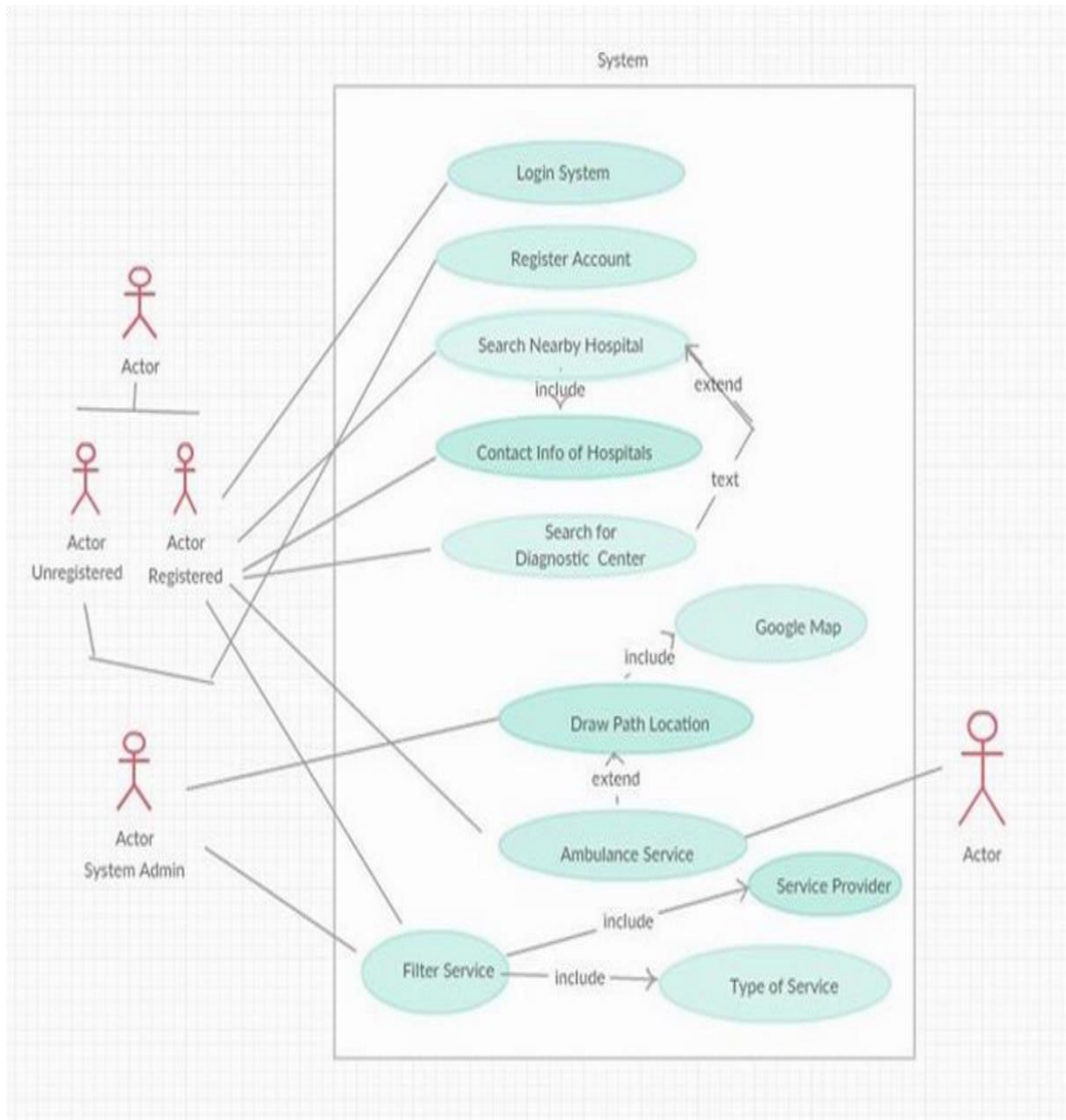


Figure 07: Use case diagram for the system

In the above use case diagram, we have shown the whole architecture of the system. How user will enter into the system. How they filter the hospitals, diagnostic services. How people will search other healthcare facilities and the direction path to the health care service provider. We have integrated Google map into the app for the exact location of health service provider.

We have tried from the very basic of database that's why we have drawn some state diagram also to understand the requirement of the software.

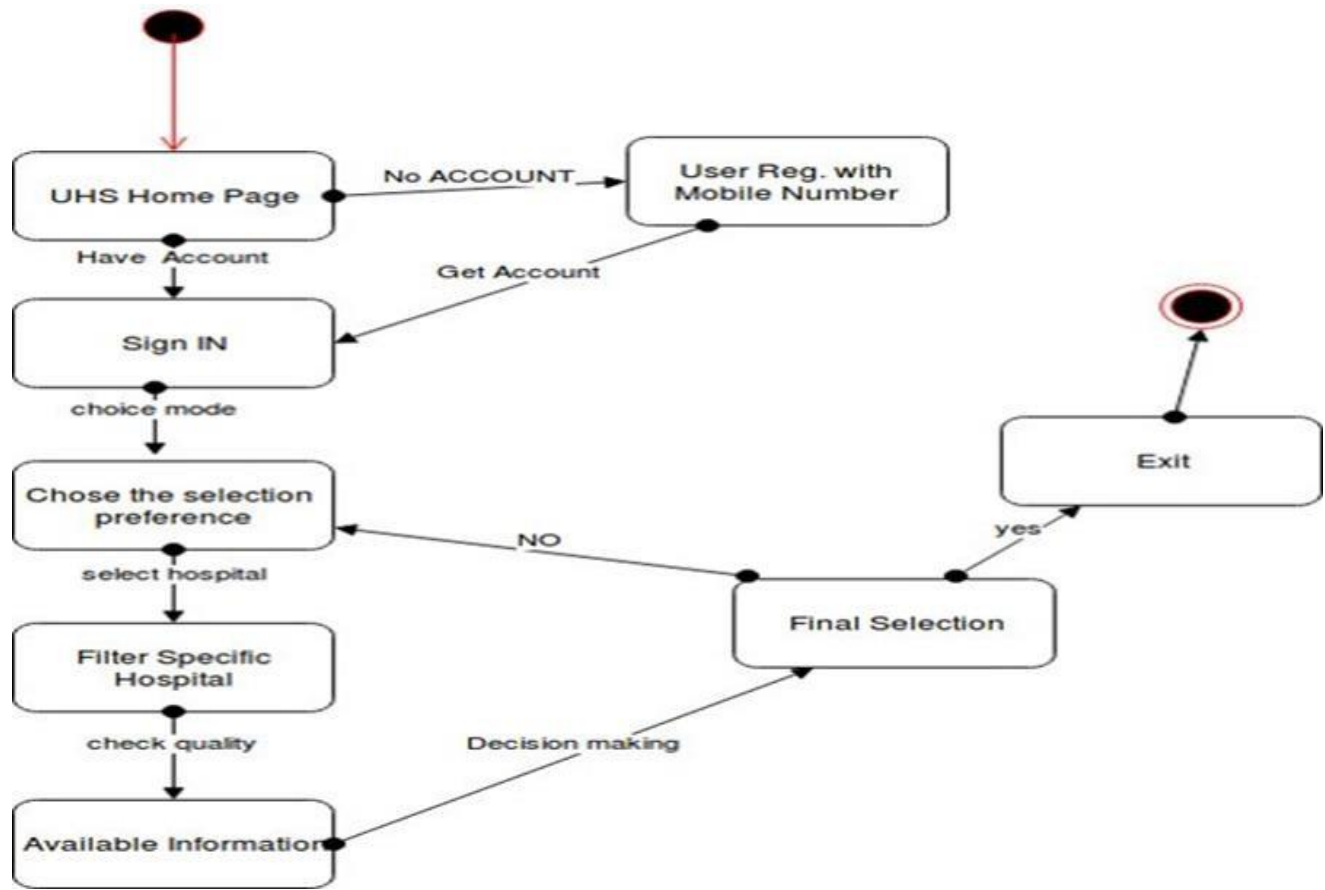


Figure 08: State diagram for the Hospital searching service

The above state diagram shows how users can select the nearby hospital/diagnostic center according to the availability of facilities of the specific hospital. Users need to open an account to see the history of the hospital.

3.3.2 ER Diagram of UHS

The app is about searching the healthcare service provider like pharmacy, hospitals, diagnostic center, optics shop, dental care everything related to health care and the details information of

hospitals and diagnostic center. As we got some data from ICCDR, B. We extracting their data. After extracting their data we got lots of data we analyzed them very carefully. And then we got some duplicate data we sort out them and got some data. And it was designed on their way in their DB. So we redesigned it on our own way.

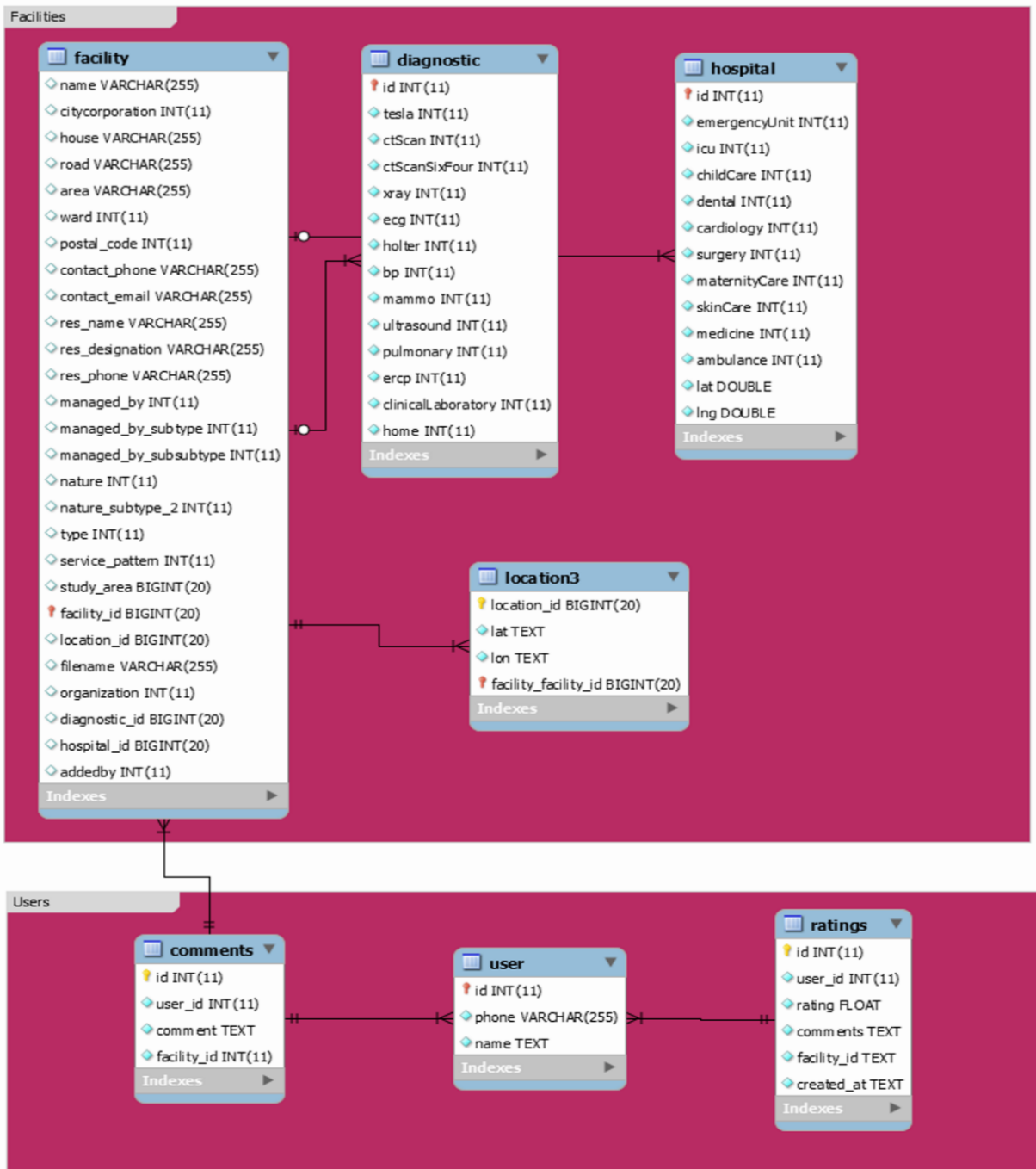


Figure 09: ER diagram of UHS

3.4 UHS User Interface & Design

We are trying to give people the best service. Our main goal is give accurate information. So we are collecting data by own .Manually it is tough to upload the data into database. So at first we have created an android application for uploading data.

3.4.1 UHS Informer Application:

Our first challenge is to make a user friendly android informer application. After starting the application it will automatically detect the location of the device. Then we have to select the type of the provider like the below figure. If it is pharmacy, blood center or other health service provider except hospital and diagnostic center user need to writhe the name contact information then hit the upload button like the below picture.

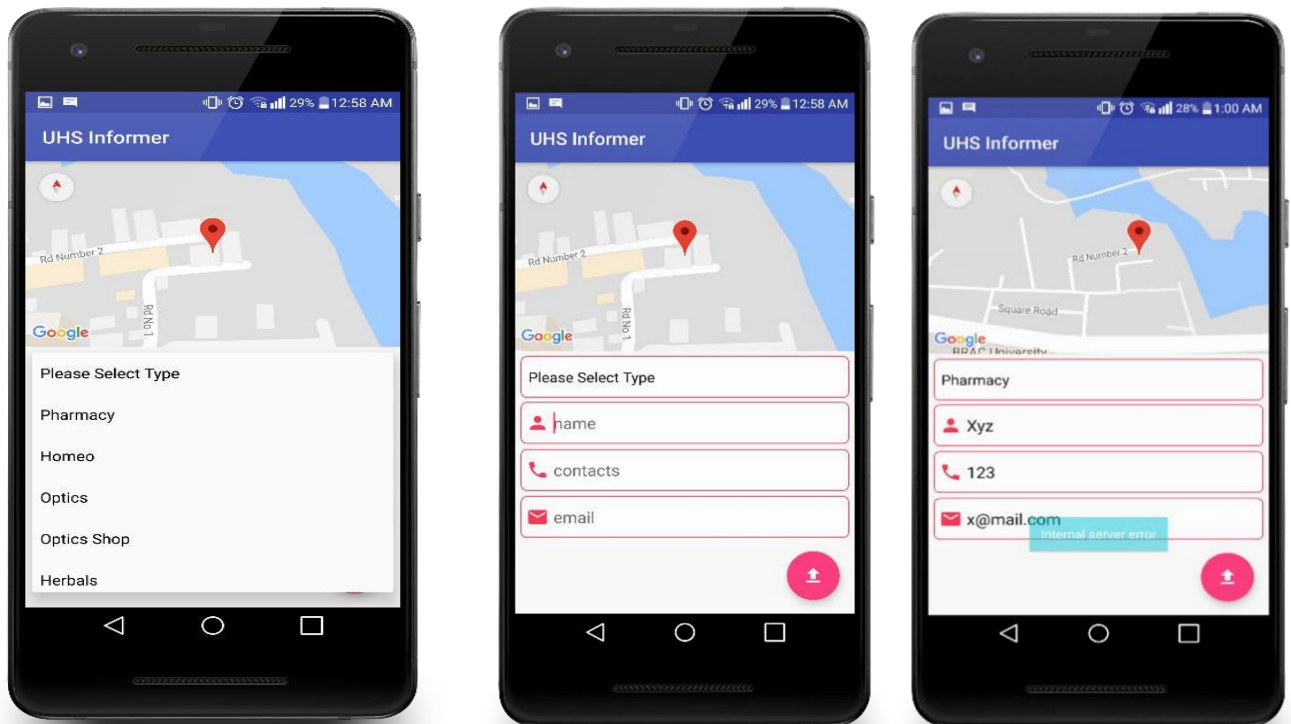


Fig.10: View of UHS Informer Application

Using this informer app, for hospital and diagnostic user needs to include the facilities and upload the data. We have made live so that after uploading main application can see the information.

3.4.2 UHS Main App:

Our main focus is people will use the services of the health care provider more effectively. Most of the time it will be used on emergency time so it should be simple and user friendly.

Home Activity & Registration Activity:

This is the fundamental arrival screen of our UHS (urban Health Service) application. From here a user can explore both to the login and registration screens.

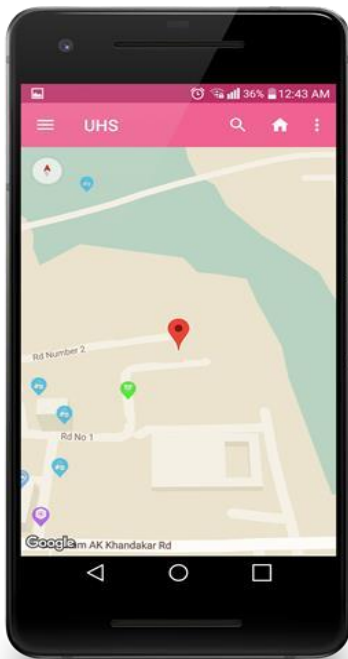


Figure 11: Home Screen of the app

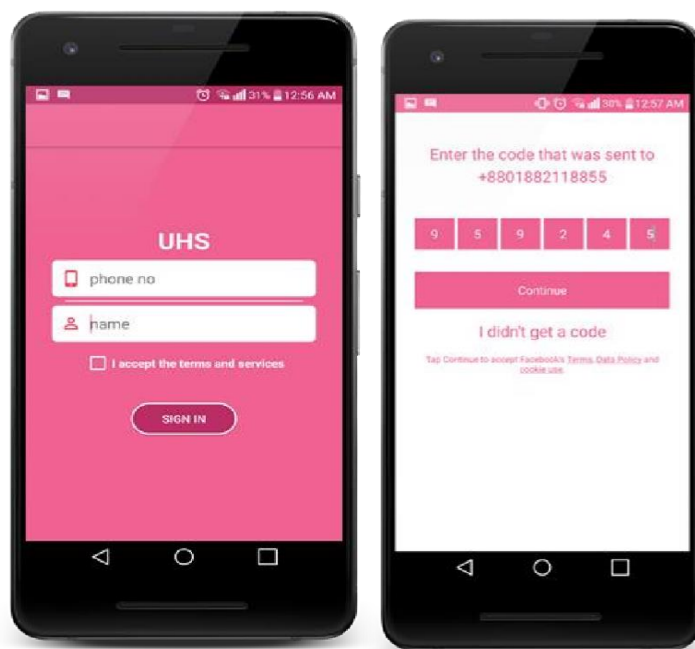


Figure 12: Registration Activity

In the android application of UHS home screen will appear with detecting the location of the device like figure no 11. Then there will be registration process for rating the hospital quality. We have

used phone number authentication process for the registration like figure number 12. A code will send to the phone .The code will be used for registration process. This is one time process. User need be registered for one time.

User View of Whole Process:

In this part we have showed how user will using the application. In the screen of smart phone user will click in the logo of UHS. User need to turn on the GPS because it is a location based application service. Without turning on the GPS, application cannot detect the device. And then home screen will be appeared and nearest available health service provider will be showed in the Google map like figure 13.

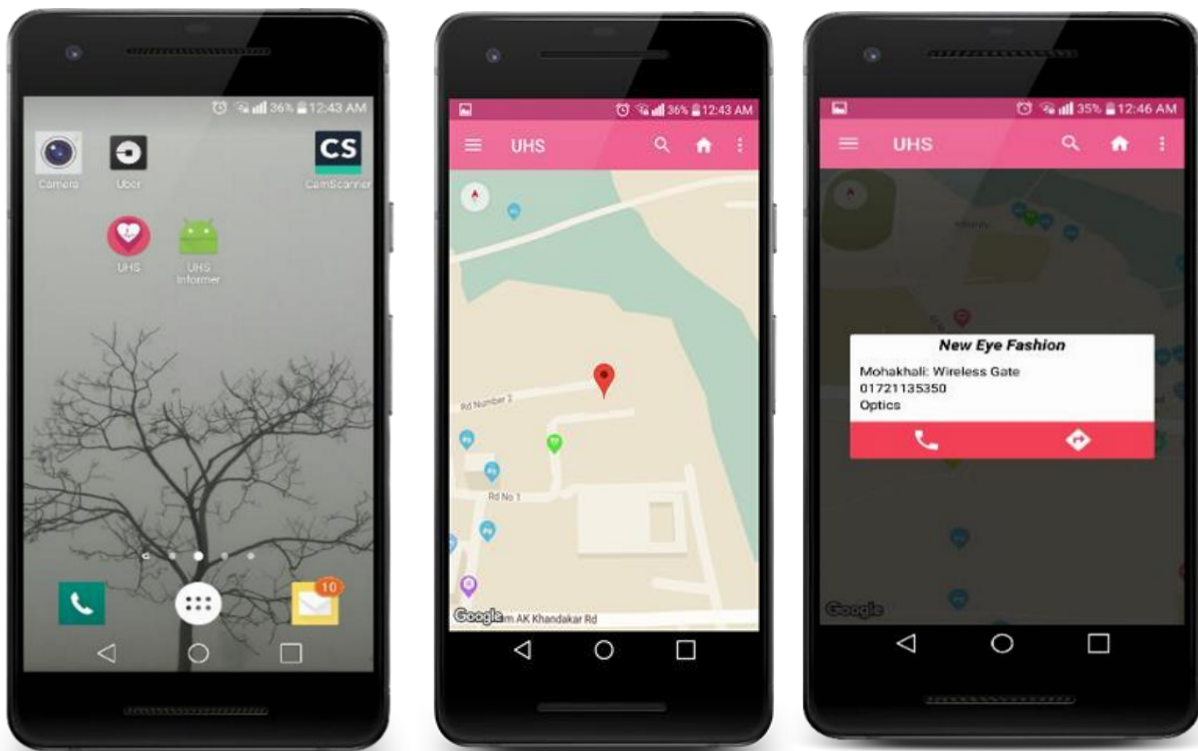


Figure 13: User view of starting process

We have created different logo for different type of service provider. User can click the desired service provider's logo and then it will show the detail information of the service provider. Then user can click on the phone number or direction tab for the location.

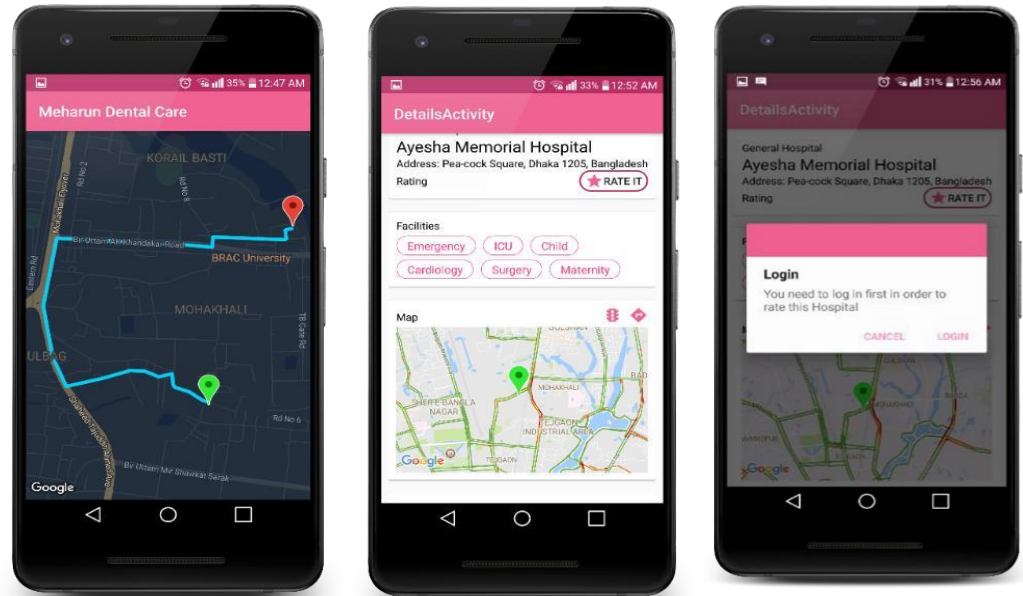


Figure 14: User view of whole process

If the user click on direction application will show the route path of the health service provider. If users click for the Services like diagnostic center and general hospital it application will show the available facilities of the providers. User can rate the quality of the hospital like and add additional comment like figure 13 & 14.

Even user can search for the desired provider in the search button like figure 15. Even users can search only the specific type of the health service provider. Then app will show the only desired type in the Google map like figure 15.

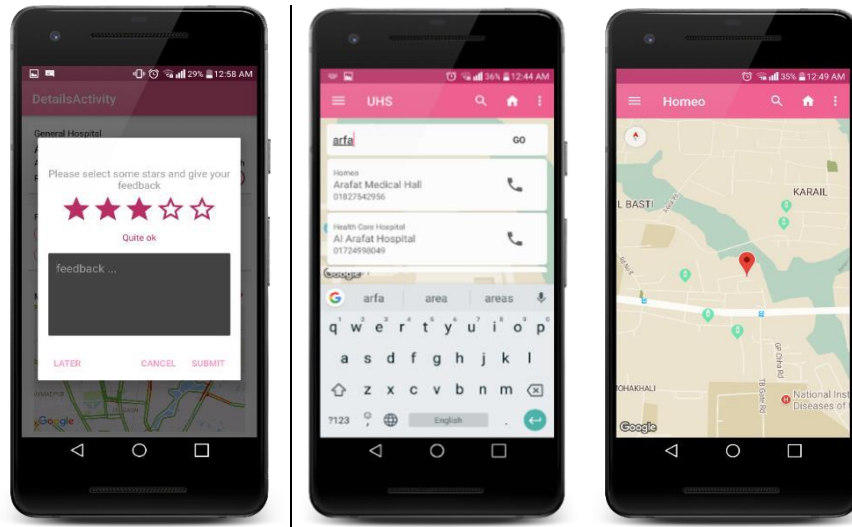


Figure 15: User view of whole process

Web Interface Design:

We have made same application for web site. But we have added an extra feature in the web based application. Users can filter a specific area with all the information of hospitals and other healthcare services. By doing so, users can find out the best one with best facilities easily and can know the distance with direction also.

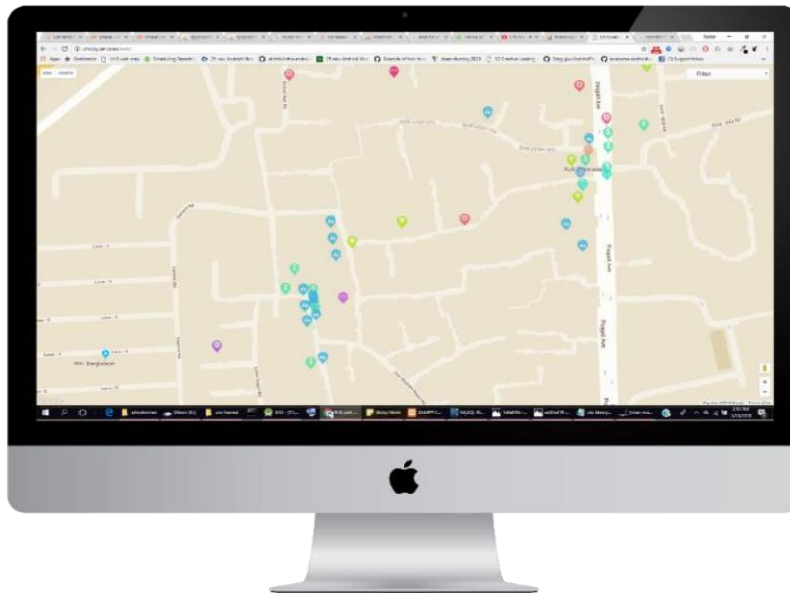


Figure 16: Web Interface Design

Chapter 4

Data Collection

In fourth part the paper we have describes some methodologies of collecting health care data, existing data sources and lastly showed some experimental data.

4.1 Methodologies

We are providing the information of locations of health care service provider.ad we also offering the facilities of hospital and diagnostic center. So it's all about collecting health care related data Methods used to collect data on health and health care can be characterized by the following features.

- Sample versus census: A few information are gathered for the whole populace to which they apply; such information are in some cases alluded to as evaluation information. One case is the genuine decennial enumeration, which expects to get checks by geographic area and essential statistic qualities for the whole occupant populace of the United States. In any case, the term statistics might be utilized to allude to any information gathering went for gathering information for each unit in the number of inhabitants in intrigue (i.e., a subset of a bigger populace of accentuation). On the other hand, numerous information can't be gathered for the whole populace without over the top cost or potentially a weight on respondents. Rather, the information are gathered from a subset of the populace, or an example, that is chosen (for the most part by randomization) in a way that makes it illustrative of the whole populace; subsequently, appraisals can be computed from the example that surmised those for the whole populace [15].
- Based on administrative records versus respondents: A few information are separated from records that as of now exist since they are essential for the organization of a program or intercession. Illustrations are government records (assess documents, standardized savings

and Medicaid enlistment, school enlistment, mishap reports), business records (wellbeing design enlistment documents, restorative cases), and therapeutic records (from doctors' workplaces, doctor's facilities, and different suppliers of social insurance). Other information are gathered straightforwardly from respondents, for instance, by meeting people about their encounters. The line between the two may not be totally particular; for instance, a doctor may be requested to give information got from the medicinal records she utilizes as a part of her training; in this manner the information accumulation is respondent based, however the information are at last gotten from managerial records. On account of youngsters, most respondent-based information are gathered from intermediary respondents (e.g., guardians and parental figures). A third classification to consider is that relating to clinical information, for example, observational examinations.

- Population- versus service-based: A few information accumulation endeavors center around an all-inclusive community characterized just by expansive statistic qualities, for example, all kids under age 6 or every pre-adult young lady. Other information accumulation endeavors in wellbeing and human services work just through particular destinations or executives of administrations, for example, wellbeing designs or centers; such administration based information gathering can cover just sub populaces characterized by their connection to the specialist organizations.

4.2 Data Collection Methods

	Source	Census	Sample
Population-based	Administrative records	Vital statistics	Some components of Medical Expenditure Panel Survey (MEPS) cost data; national samples of discharge abstracts, etc.
	Respondents	Decennial census	Most national surveys (e.g., Behavioral Risk Factor Surveillance System [BRFSS], MEPS, National Health Interview Survey [NHIS], National Immunization Survey [NIS], National Survey of Family Growth [NSFG], Pregnancy Risk Assessment Monitoring [PRAMS])
Service-based	Administrative records	Some Healthcare Effectiveness Data and Information Set (HEDIS) measures (those available in plan billing records)	Some HEDIS measures (those requiring medical record review)
	Respondents	Health plan collection of race/ethnicity data	Consumer Assessment of Healthcare Providers and Systems (CAHPS) measures

SOURCE: Committee on Pediatric Health and Health Care Quality Measures.

It ought to likewise be noticed that none of these refinements bears an ideal relationship to the qualification between healthcare and healthcare related information [15]. The consistency and accuracy of the measurement method are directly associated with the quality of the data collection. As we are collecting data by ourselves accuracy and consistency of data is out of question.

4.3 Existing Data Sources

Icddr,b supports numerous surveys and information systems that shows us the information of health care service provider. Icddr,b have given us information about the location, their

information details. But there was problem with that data because facilities are not available on those e data sets. So we have to go those service provider and collect information of the facilities of hospital and diagnostic center.

4.4 Data Collection Region

The main part of our thesis project is collecting data of health service provider from various city of Bangladesh. Therefore it was very difficult for us to go every provider's location, collect their information and take note of those information. At first we thought that first of all we will collect the information manually and later we will upload the information in the database. As our first idea was collect information from as many cities from Bangladesh so it would be very difficult to manage large amount of data. Then we came up with an idea to making an android application for uploading the information.

We have made an android application "UHS informer app" to collect the data. It is very user friendly and easy to use. It will automatically detect the device location. Then we have to put the name of the provider, their detailed information and upload the data into the information.



We have collected information from various city. As we are from three different region of the country we have tried to collect information from those areas.

Dhaka City

It is a huge task for us to collect the information from Dhaka city. As Dhaka is the most densely populated city therefore number of health service provider is huge. And finding an exact location is also a difficult task for us.

We have tried our level best to collect as much information from around the city. We almost cover up the whole Dhaka city.

Marker's Name and icon for different health service provider:

Logo	Name
	Blood Bank
	BRAC Delivery Center

	Dental Care
	Diagnostic Center
	EPI Center
	General Hospital
	Health Care Hospital
	Herbal
	Homeo
	Optics
	Optics Shop
	Pharmacy
	Rehab Center

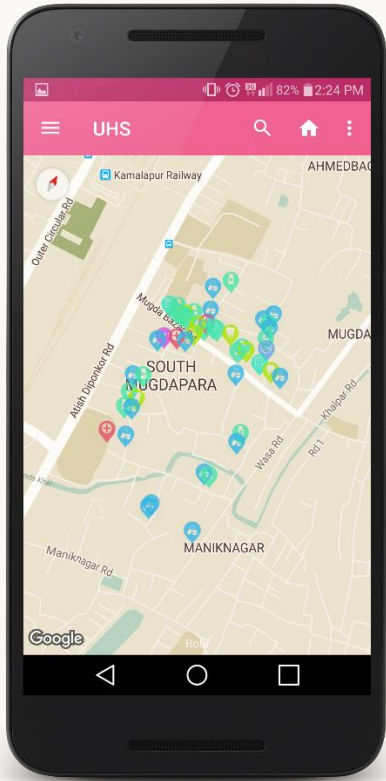


Figure 17: Kamalapur railway area

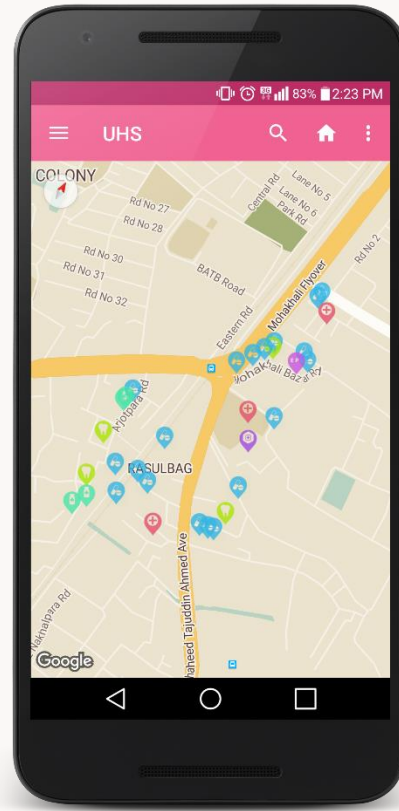


Figure 18: Mohakhali Rail Crossing Area

In the above figure we have shown some data of some areas of Dhaka city in Google Map.

Chittagong City

Chittagong is the second most densely populated city in our country. Therefore it was also tough for us to collect data. We have collected data from almost all important areas in Chittagong city.

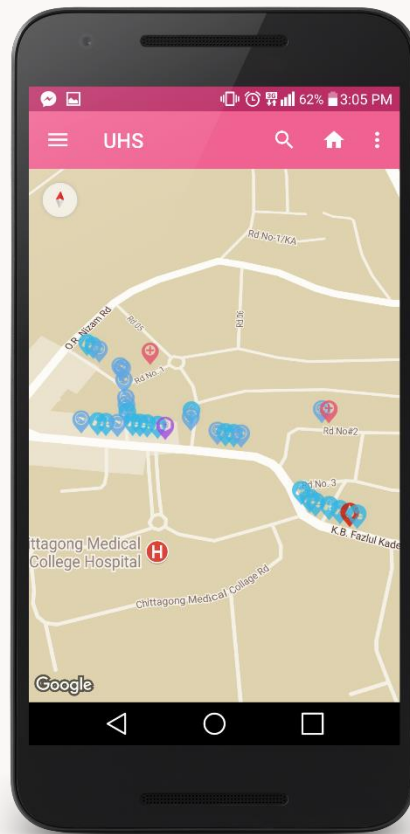


Figure 18: Chittagong Medical Collage and Hospital Region

The above diagram shows some service provider around Chittagong medical college and hospital region.

Rajshahi City

Rajshahi is not big city like Dhaka or Chittagong but collecting data is always crucial. Health care service providers are scattered through the city. Therefore it is tough for us to collect the data.

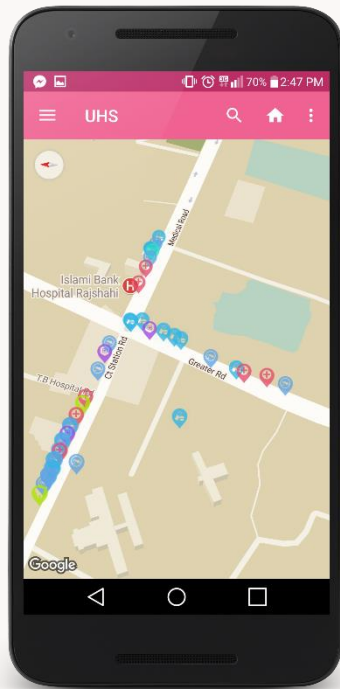


Figure 19: Rajshahi ct Station Road

Rangpur city

Rangpur is one of the developed city in north Bengal region. People from nearby district comes here for medical treatment .therefore number of healthcare service provider is much more here than other district.

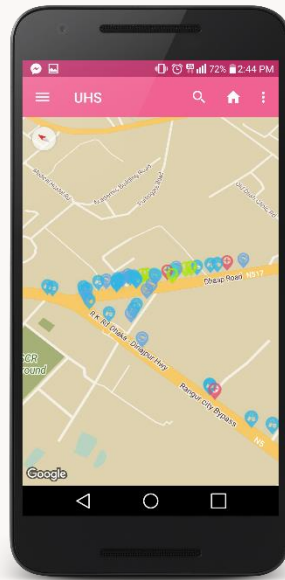


Figure 20: Rangpur DHAP Region

Dinajpur City

Dinajpur is one of the biggest district in north Bengal. It has filled with lots modern hospital. Therefore many people come here for medical treatment.

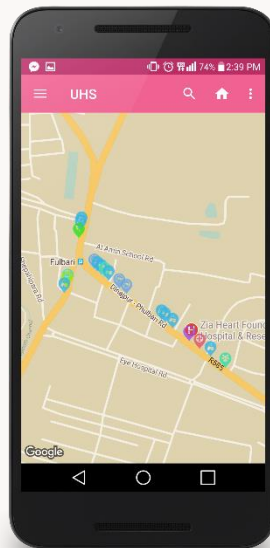


Figure 21: FulBari Bus stand, Dinajpur

Sylhet city

Sylhet is in the eastern part of Bangladesh. We have also tried to collect some data from sylhet city region. As it is divisional city it has numerous number of medical hospital and other related Service.

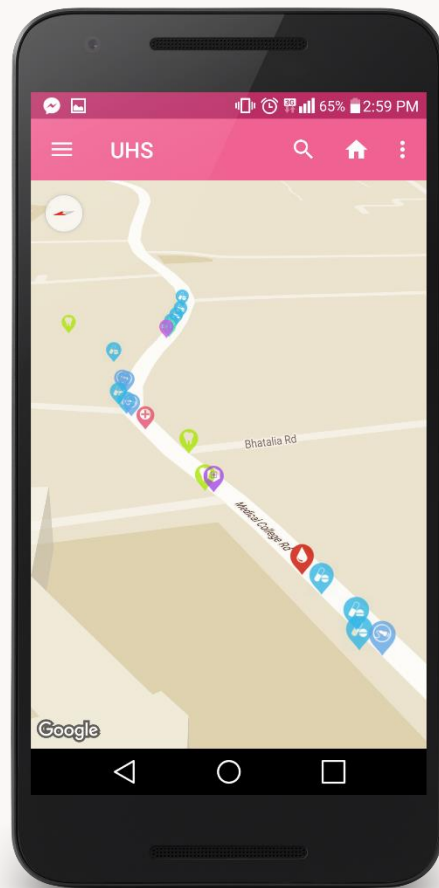


Figure 22 : Medical collage Road, Sylhet

We have tried to collect as many data in these limited time . It was a huge task for us to collect the data from numerous areas . It is a time consuming process therefore collecting data is huge task for us.

4.5 Experimental Data

We have collected data from several healthcare related service providers of Bangladesh. To provide the user about the correct information of those hospitals, we went there and retrieve different information for the benefit of the users. We asked them about the information by which user can make a decision before choosing a hospital, what is the direction of the hospitals, what are the services of the hospitals, user can give feedback of the hospitals. Using the information, we have given the user intelligent suggestion based on- quality and facility. We have considered the following criteria as input: Name and the location of the hospitals, pharmacy, optical shops, dental care centers, Rehab Centers, Login Authentication and Emergency service.

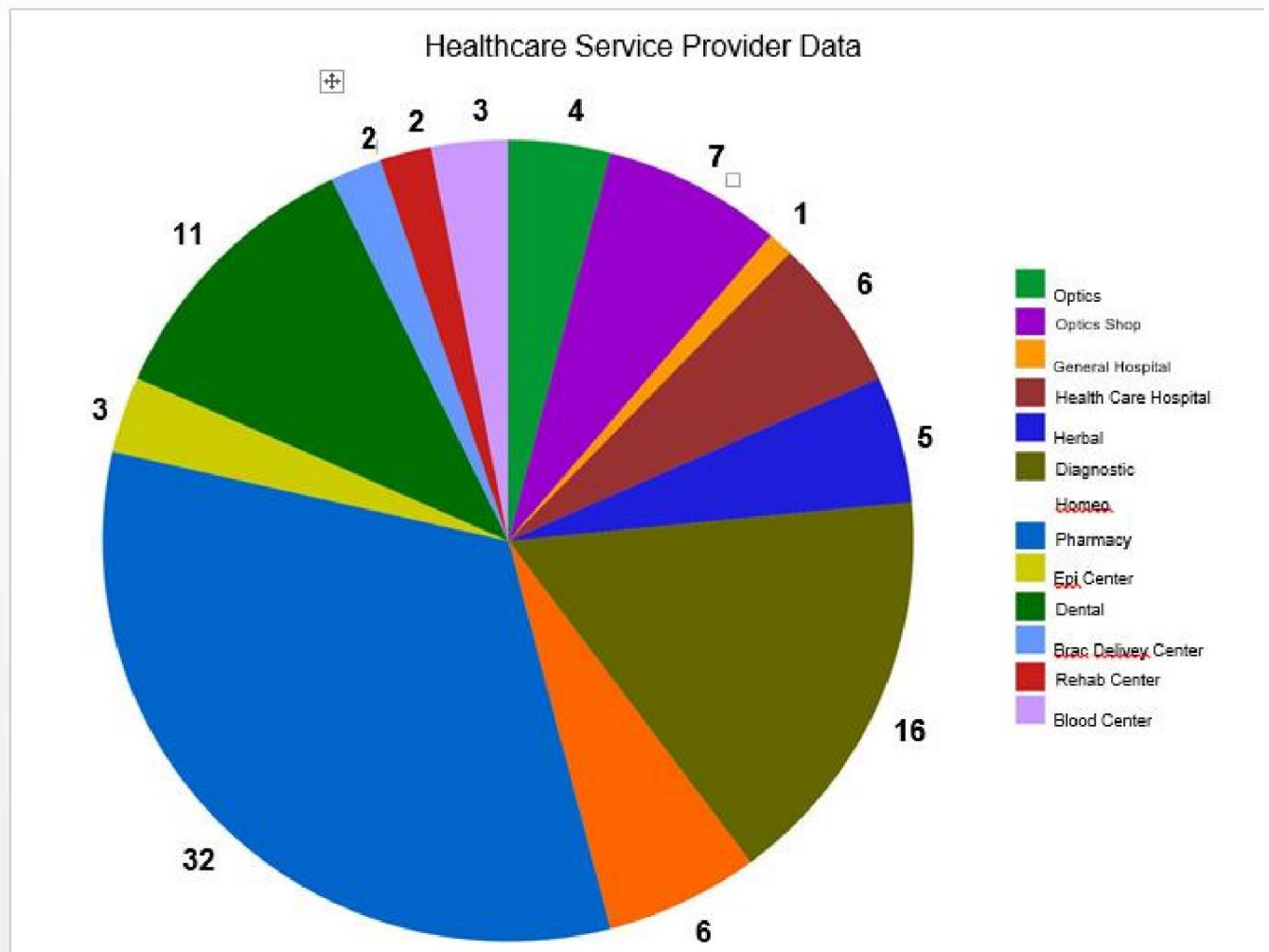


Figure 23: Healthcare service provider in Rangpur

Chapter 5

Conclusion

5.1 Limitations

Our main goal is to give users perfect location about the health care service provider. So the exact location of the provider is mandatory. But it is very tough to give the perfect location through android app.

In the comparison to laptop computers, the small internal storage capacity, processing power and screen size of the mobile phone often involves apps that are running to be in reduced format.

We have collected data through visiting the spots and uploaded the data by using the informer application. But if the provider changed the location or closed the services permanently, then we cannot provide the updated data immediately to the user. So, the user may face some problems for this application.

Medical and diagnostic facilities are available in our application as we are uploading the accurate information. But it's difficult for us to show us the updated facilities of that hospitals and diagnostic centers.

5.2 Future Goals:

For future work, we are planning to upgrade the model and introduce some advanced data from the healthcare providers. This will help health applications to quickly take actions such as sending alert to patients or care providers, getting doctor's appointment, cabin booking system, getting information about the availability of ICU, getting the results of diagnostic tests. Furthermore, we are planning to build a health ontology model to automatically map discovered appliances to potential activities. This means we can efficiently train the system and increase the accuracy of detecting human activities. We are trying to improve the health care facilities in Bangladesh. So our main focus is that, people will use the facilities in the best way.

5.3 Conclusion

We are trying to improve the health care facilities in Bangladesh. So our main focus is that, people will use the facilities in the best way. Now-a-days, the use of the smartphone is suitable and flexible to use to all class of individuals. It can be used for data sharing, data collection, analysis of data. We address the working overview of urban health service application and its advantages. So that everyone can get conscious of this app and they can use it regularly without any kind of complexity. Instead of being panic, people may find a quick and effective way to reach the solution with the help of this app. In future, we hope to work extensively on this to develop it to a new level for the betterment of people, especially the poor. This way, it is hoped that mobile and web based healthcare system will be a useful part and parcel of everyday life.

References

- [1] Maged N Kamel Boulos^{1*}, Steve Wheeler², Carlos Tavares³ and Ray Jones¹, ‘How smartphones are changing the face of mobile and participatory healthcare: an overview with example from eCAALYX’ from <http://www.biomedical-engineering-online.com/content/10/1/24>
- [2] T. Laakko, J. Leppänen, J. Lähteenmäki, A. Nummiahho, ‘Mobile Health and Wellness Application Framework’ from www.methods-online.com on 2015-08-25 | ID:1000321458 | IP: 157.142.237.188
- [3] ANDALEEB, S.S., ‘Public and private hospitals in Bangladesh: service quality and Predictors of hospital choice in HEALTH POLICY AND PLANNING;’ 15(1): 95–102
- [4] A.Carpio, J. Kim, R. Hoda, ‘MedTouch: Towards the Development of Smartphone- Based Software Solutions for Mobile Health Care,’ Proceedings of Australasian Software Engineering Conference, June 2013
- [5] K. Hung, Y.T. Zhang, ‘Implementation of a WAP-Based Telemedicine System for Patient monitoring,’ IEEE Transactions on Information Technology in Biomedicine, vol.7, No. 2, June 2003.
- [6] R.A.Nimbalkar, R.A. Fadnavis, ‘Domain Specific Search Of Nearest Hospital A Healthcare Management System,’ Proceedings of Recent Advances in Engineering and Computational Sciences (RACECS), pp. 1-5, March, 2014
- [7] Wang,H,Liu,J. ‘Recent Patents on Biomedical Engineering’, Volume 2, pp. 15-21(7), January 2009.
- [8] Tachakra S1, Wang XH, Istepanian RS, Song YH., ‘ Mobile e-health: the unwired evolution of telemedicine’, 9(3):247-57, Sep 2003
- [9] OlavBjørnson, F. ,Dingsøy, T., ‘Knowledge management in software engineering: A systematic review of studied concepts, findings and research methods used’, Information and Software Technology, Pages 1055-1068, Volume 50, Issue 11, October 2008.

- [10] 'Market share of smartphone OS in Bangladesh',
'<https://www.statista.com/statistics/528256/mobile-operating-system-share-in-pakistan/>'
- [11] X Zhao, D Tian, 'The architecture design of streaming media applications for Android OS',
IEEE Trans. Intell. Transp. Syst., pp. 1129–1139, vol. 14, no. 3, Sep. 2013.
- [12] Robert Chin, 'Java for Android', Beginning Android 3D Game Development, pp. 29-56.
- [13] Mike Wolfson, Donn Felker, 'Android Developer Tools Essentials: Android Studio to Zipalign', Proc. Int. Conf. Comput. Commun. Inform. (ICCCI), Coimbatore, India, pp. 14, Jan. 2014.
- [14] Myers, J. Hodes, T Scott Hotes, 'System and method for managing third party application Program access to user information via a native application program interface (API)', Proc. 12th Int. Conf. ITS Telecomm. (ITST), pp. 77–81, 2012.
- [15] 'Child and Adolescent Health and Health Care Quality: Measuring What Matters (2011) Chapter: 3 Current Data Collection Methods and Sources',
<https://www.nap.edu/read/13084/chapter/5#69>.

