

Urban Healthcare Facilities Using Mobile Application



Inspiring Excellence

by

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Declaration

This is to certify that this final thesis report is submitted by the authors for the purpose of obtaining the degree of Bachelor of Science in Computer Science, and the degree of Bachelor of Engineering in Computer Science and Engineering. We hereby declare that all the instances of work presented in this thesis are original and inspirations for the work that we have made use of have been duly accredited with proper referencing.

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Abstract

Bangladesh is the ninth largest country in terms of the size of its population in the world. It has made remarkable progress to achieve the millennium development goals to improve the quality of life of its citizens. On its approach to push ahead with the advancement objectives, the nation has gained amazing ground in the medicinal services area as well. However, Bangladesh still has to elevate its path to advancement, one of which can be done by offering its citizens the type of healthcare services pursued by people of most of the developing countries. In this context, technology can be a key empowering agent to accomplish Bangladesh its dream and the uplifting news is so far the country is utilizing different technological advancements, such as, mobile communication, internet, etc., in the best possible way. The application is not just confined to locating registered doctors, the functions also include locating pharmacy, diagnostics center, health clinic and hospital. Basically, this mobile application can be used as a one stop service point for general public in order to locate desired mobile services. The data that we will be incorporating into our mobile based application will be authentic so that it will give us the actual location of the desired medical entity. HealthCare is a mobile application that will help people to know all the nearby health facilities and it has a vital role to help people during medical emergencies. The application will also set an appointment with the doctor so saving people from the hassle of calling and taking an appointment.

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CHAPTER 1

Introduction

Health care access, affordability, and quality are problems all around the world. There are well-established disparities based on income and geography, and the high costs of health care present affordability challenges for millions of different people. Large numbers of individuals do not receive the quality care that they need. Mobile technology offers ways to help with these challenges. Through mobile health applications, sensors, medical devices, and remote patient monitoring products, there are avenues through which health care delivery can be improved. These technologies can help lower costs by facilitating the delivery of care, and connecting people to their health care providers. Applications allow both patients and providers to have access to reference materials, lab tests, and medical records using mobile devices.

1.1 Motivation

Numbers of hospitals, pharmacies, diagnostic centers are increasing day by day. It is very difficult to find the proper medication center. And also the number of people dying because of not getting the right medical facility at the right time. HealthCare application will help people to know where to go during emergencies and people can also compare among hospitals which one is better.

1.2 Thesis Outline

The outline for our thesis is as follows:

- Chapter 1: the introduction of the thesis, the motivation behind creating this system as well as the system of our thesis work.
- Chapter 2; this contains the background study done for the thesis, which includes current healthcare facilities in our society. The chapter also includes the literature review that sheds light into the purposes of making this system useful.
- Chapter 3; presents an overview of the system, a bird's eye view on how the system works. It also includes how the user will use the system.
- Chapter 4; provides a detailed description of the actual implementation of the system developed, including all the structural and functional details of how healthcare mobile application is built.
- Chapter 5; the results of our project
- Chapter 6; highlights the system limitations owing to practical circumstances, the work that can be done in the future, as well as newer features that can be implemented.
- References are provided at the end of the report for easy access to important terms, and for ease of comprehension on all the relevant information regarding our HealthCare application.

CHAPTER 2

Background of Study

The introduction of Urban HealthCare Mobile Facilities have carried with them an entire scope of arrangements in any case, in the meantime, an entire diverse arrangement of issues that should be tended to in arrange for it to be viewed as a reverberating achievement. M-health, the use of mobile computing and communication technologies in health care and public health, is a rapidly expanding area of research and practice [1].The motivation behind this study think about into what constraints the as of now accessible frameworks have is a state of enthusiasm with the end goal of our Urban HealthCare Facilities, as we mean to minimize as much issues and concerns tormenting current frameworks as conceivable, so that the way toward healthcare is as smooth, snappy, compelling and solid to lead as would be prudent.

2.1 Literature Review

There are various mobile application categories available to be downloaded from the online Google play store. Google has never disclosed any information regarding the number of apps being added on to play store on daily basis. [2]. Several applications that are related to health care are available in the medical category that helps to form vital sign parameters, vaccinations schedule, medicine reminder etc. Many hospitals just centralize their very own hospital so providing a mobile application to easily locate the hospital. A mobile health care application named Summit health app that provides urgent care locations in the Summit Health care network of central Pennsylvania.[3] One can easily tap to view urgent care locations, get turn by turn navigation to all emergency care locations, and use the find a provider feature to find a physician or other specialist nearby. Other criteria of medical applications are available that gives the location of the nearest hospital. We have broaden the perspective of a health care facility by locating not just only hospitals but any type of registered health care facility be it pharmacy or a diagnostic center. In Bangladesh, many researchers have found that prescribers are in favor of

practicing pharmacists as patient counselors and drug information providers. So pharmacies also play a significant role in Bangladesh during medical emergencies. Therefore, in a country like Bangladesh where people are not still aware about health emergency issues, requires a mobile application that common people can eventually use to seek help to find nearest registered medical facility and can also have a detailed overview of that facility for example, number of beds, name of doctors, etc.

CHAPTER 3

System Architecture

E health applications can improve prevention of illness and delivery of treatment[4]. This has mainly driven our motivation and also thinking of the common people of Bangladesh, we have decided to implement such a system.

The tasks that our android based system will undertake has been classified into three ways: firstly locating the location of the user by accessing the GPS location on their android phone and displaying it on the google map. Secondly, simultaneously extracting the location of the facilities from the database on the server and displaying them as markers on the map. Thirdly, the user can request for an appointment to their preferred doctor and get an answer from the administrator of the confirmation. These three functions comprise together to form the basis of our system.

The system architecture of the system is as follows:

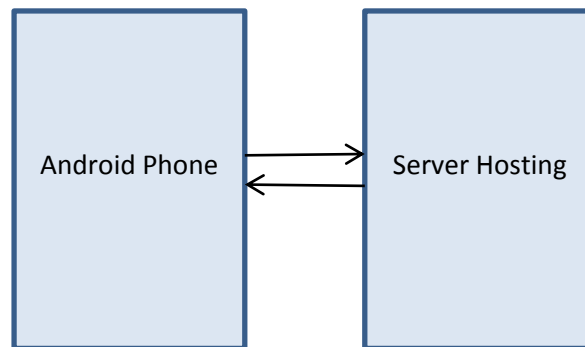


Fig 3.1: System Architecture of the Urban Health Care System.

3.1 System Overview

As mentioned earlier, we have divided our system into three components according to the different functionalities. As soon as the user opens the mobile application on their android phone, the mobile application will seek the permission of the user in order to access the GPS location of the user. By the help of the GPS receiver, the mobile application will be able to locate the location of the user and then immediately extract data from the database and display all the available health care facilities nearby the user's location. Right above the google map there is a search option from which the user can directly type in the name of the hospital that he or she is looking for. This saves the time of looking in depth if one is already aware of the name of the hospital or medical service.

By clicking on the name , the user will be lead to see the location .The system is not confined to do this only , when the user zooms in to have a closer look onto the map , the user can eventually get all the information he or she wants regarding that particular health care service by clicking onto that particular marker. With one click onto the marker, the user will be redirected to another screen that will have a scroll view of all the information that one requires from a health care facility. The display will be comprised of information such as contact number, name of the specialist and cost of the services, etc. All this information is authentic and has been analyzed from a survey conducted by The International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR). [5] We have used an authentic database that contains real time information and so it will help common people to get their desired information during emergency

situations.

At the corner of the activity there is an option menu that shows facility info, specialists, list of services, cost of services, and provision for poor, note and ask for appointment. Facility info shows the detailed information of that particular facility such as number of staff, contact number, days of service, type of service etc. The list of services show the services currently provided by the facility for example Apollo Hospital Bangladesh provides a wide range of facilities, one of which includes laser and cosmetic services. Similarly, the other option of the list and that is the cost of services. Cost is a major issue when it concerns medical emergencies so this option makes it easier for common people to choose which hospital or clinic is affordable because not everyone has got the capability to afford high end hospitals. Provision for poor is a service that various health institutes provide to help the poor people get proper treatments and by clicking on it the user can easily know whether the hospital provides certain type of compensation benefits for the treatment of the poor and if so then what the benefits are. The note provides information about any observations that the user has come across and can leave their query or comment regarding the issue. Lastly, another important feature that our mobile application provide is asking for a doctor's appointment. After the ask for appointment option is clicked by the user then a new screen appears on which the details of the patient that is name of the patient, phone number and date of setting the appointment. On completion of filling out the requirements, the send button will carry the details of the patient and store it onto the database from where the database administrator shall send a feedback ensuring the appointment setting.

3.2 User Groups

The users of this system can be classified into two categories: User and Administrator.

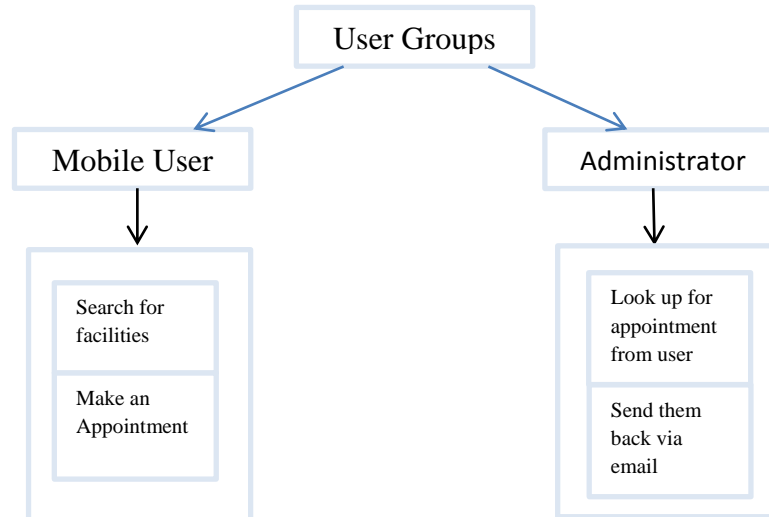


Fig 3.2 System User Groups

The user group in this application is very general. The mobile application user is generally the person who is going to use the android based mobile application. To narrow it down, the mobile users are actually the common people so the system is designed in the simplest way possible so that it is user friendly and is not complicated for people with minor skills on operating android phones can smoothly use this mobile application. The user has their independence to seek for the information that require from the application and search for the facilities that they require to

locate. The user will also go to the ask for appointment option in order to place an appointment for the doctor they desire. As the fig 3.2 shows the administrator approves the request that has been made by the patient and then sends out an email to the patient for the confirmation of the appointment.

Chapter 4

System Implementation

Our urban health care facilities mobile application consists of only a software layer. The main functionality was within the android application and to connect the android application with the database that contains all the information of the facilities. The library being used in the application inside of the Android device provides a synchronization pathway with the server within which the database that we are using is present and to extract data from the database and display it onto the google map. The web host that we are using contains support for PHP so that by creating just creating some .php files and, place them in the web directory, and the server will automatically parse them for you. The PHP script that we have created enables anyone accessing the php file within the webhost will be able to approve the request of the appointment that is being sent as input from the user.

4.1 Google Map API

Google Maps are commonly used to determine the destination location, calculate distance and approximate time to reach a destination point from your current location. Basically, Google Maps have an extensive array of application program interfaces (APIs) that let you embed the great functionality and effectiveness of Google Maps into your Smartphone applications. Google gives by means of Google play a library for using Google Maps into Smartphones application. At present, Google Maps Android API V3 are available that provides improvements to the older API version. The Google Map library gives the `com.google.android.gms.maps.MapFragment` class and the `MapView` class for displaying the map component. To access the Google Maps

servers through the Maps API we have to add a Maps API key to Smartphone application.

The key is free and can be used with any application that calls the Maps API, and it supports many users. Maps API key can be achieved from the Google APIs Console by providing application of signing certificate and its package name. The key is included in the application by adding an element AndroidManifest.xml file.[6,7]

4.2 Database

The database intended for this system has been developed using SQLite (version 3). It also has native support for Android Operating System, which means that it is convenient to bridge the application and the database. Careful thought has been put in its development, so that it uses as less space as possible. This is a critical requirement as the Android device has a relatively limited capacity for processing and storing data so we have used a web server and stored our database onto the webserver. Only an internet connection will be required in order to just access the database and pull the data and eventually show it on the google map on the application.

Name	citycorporation	house	road	area	postalcode	Study_area	Location_id	Gps
------	-----------------	-------	------	------	------------	------------	-------------	-----

Fig 4.1: Database schema for the location table

The database mainly consists of twenty tables, each containing different forms of information regarding the facilities. One of the tables is the location table showed in the figure above. The location, which essentially contains the name of the facility , under which citycorporation does

it fall, house number , road number , area , postal code , which study area it falls under , location id is a unique id given to each location to make its identity unique , Gps gives us the GPS location of the facility. For this purpose, attributes named name, postal_code, location_id are created respectively that represents these values in the location table. The location_id attribute keeps count of the location. In addition, there is also the appointments table that stores information about the patient. Relevant information includes name of the patient, email address, selection of the doctor, approved appointments etc. The approved appointments field initially is zero and as soon as the administrator approves the appointment, the field is set from 0 to 1 showing that the appointment has been approved.

4.3 Data Model

Facility
➤ name: String
➤ citycorporation: String
➤ house: String
➤ road: String
➤ area: String
➤ ward: int
➤ postal_code: int
➤ contact_phone: String
➤ contact_email: String
➤ res_name: String
➤ res_designation: String
➤ res_phone: String
➤ managed_by: String
➤ managed_by_subtype: String
➤ nature: String
➤ nature_subtype_2: String
➤ type: String
➤ service_pattern: int
➤ study_area: int
➤ facility_id: int
➤ location_id: int
➤ filename: String
➤ organization: int
➤ type: String
➤ service_pattern: int
➤ study_area: int
➤ facility_id: int
➤ location_id: int
➤ filename: String
➤ organization: int

Appointment
➤ id: int
➤ fac_id: int
➤ patient_name: String
➤ phone_number: String
➤ approved_appoints: int
➤ created_at: datetime

Fig 4.2: The structure of the data model

The basic data model that the system is based upon can be seen in figure above. The central element of the data model is the Facility. It contains all facility data, such as the facility name, description, and facility type and contact details. Each facility also includes GPS information to locate the facility on map. Besides Facility there is appointment. The appointment entity includes id, facility id, patient name, patient's phone number, when was the appointment created, appointment date.

On the server, all data is stored on JSON objects, thereby increasing the extensibility of the prototype[8]. A flat hierarchy is implemented so that loading one node does not also invoke loading its potentially vast number of children. This is especially useful when searching for keywords in the title or tags of all facilities – the location and doctor's elements of the facility do not automatically have to be loaded as well.

4.4 Flow Chart of Project Implementation

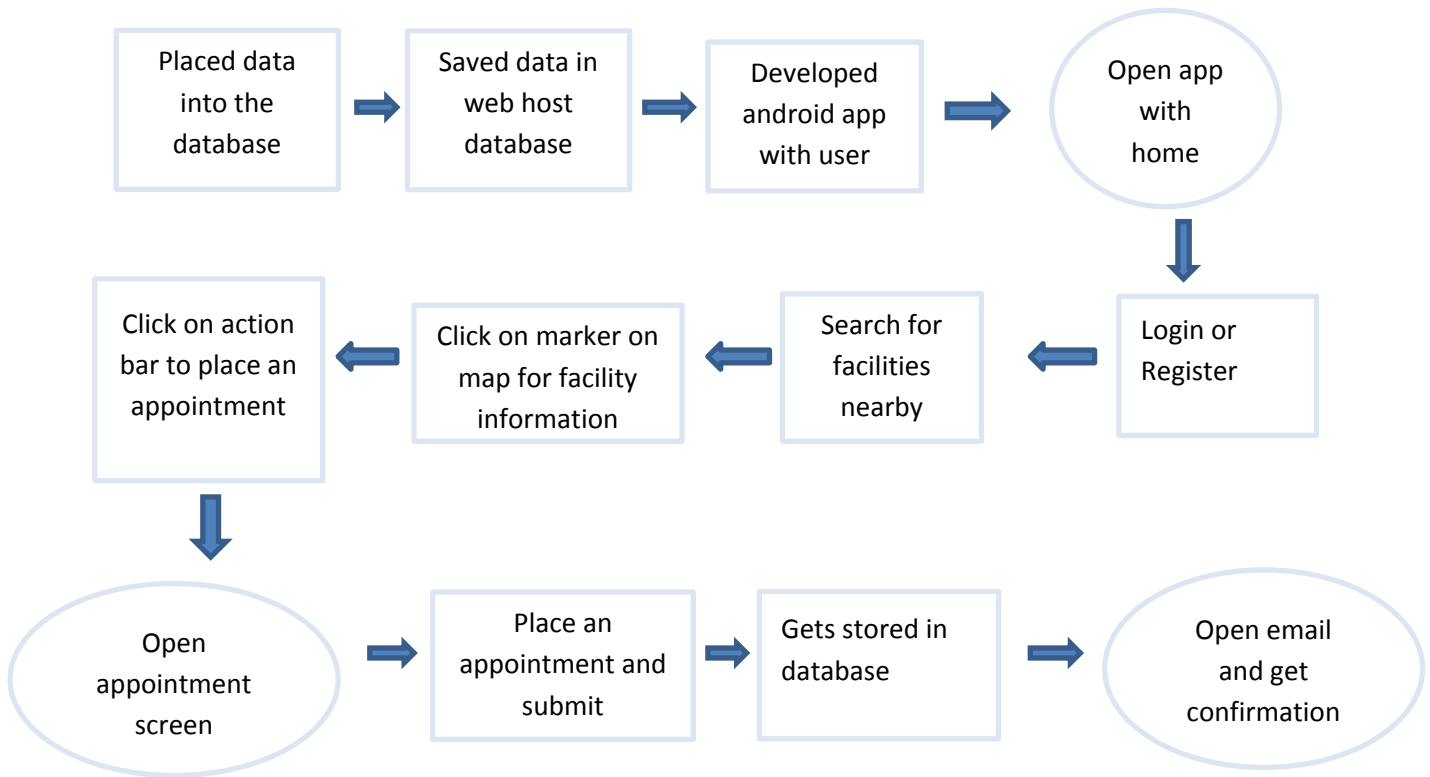


Fig4.3: Flow chart of System Implementation

4.5 System Development Kit

The application is implemented using Android Studio – 2.2.2. Packed with enhancements, this release has three major themes: speed, smarts, and Android platform support. The version that we worked upon is faster than the earlier versions with features such as the new Layout Editor, which makes creating an app user interface quick and intuitive. It contains new APK analyzer, enhanced Layout Inspector, and expanded code analysis, IntelliJ's 2016.1.3 features and much more. The new Android Emulator 2.0 is faster than ever and allows one to dynamically resize the emulator and access a suit of sensor tools which was an advantage for us since in the earlier versions, the emulator was too slow so it took a long time just to run and see whether the desired changes in the application is correct or not. The layout feature's enhancement helps to look and design the layout at the same time which was not available in the earlier versions.

4.6 System Flow

The system flow of the application is very simple as we our users are targeted to be the common people of Bangladesh. Therefore, we know that everyone is not skilled to be able to operate very complicated application which rather than providing help, creates dilemma and ultimately doesn't serve the purpose that the mobile application is supposed to serve to. Our system flow consists of firstly, the user will be directed to a login screen that will require the user to register or login. The login screen mainly comprises of a name and password that has been set after registration.

The image shows a mobile application interface for 'Urban HealthCare Facilities'. At the top, the title 'Urban HealthCare Facilities' is displayed in a purple font. Below the title, there are two input fields: 'Username' and 'Password'. The 'Username' field has a red vertical bar on the left side. Below the input fields, there are two purple buttons: 'LOGIN' and 'REGISTER'. The background of the interface is a light gray color.

Fig: 4.4 Login System

By imputing the name and password, the user will be directed to the map. The login screen is designed by a relative layout and then after designing the layout, by the username and password. So in order to authenticate the information provided the user, we have set `checkCredentials()` method sees if the username and password has matched and then it will directly show the google map.

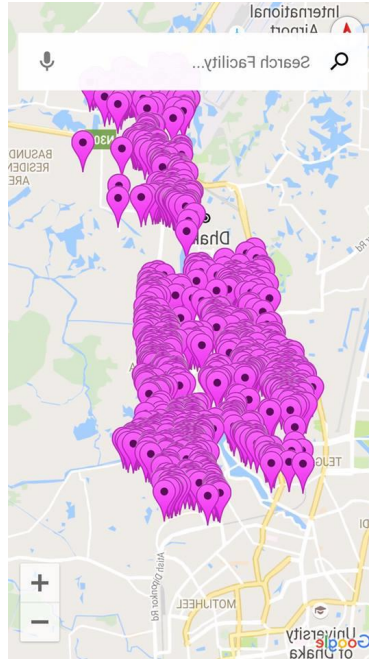


Fig 4.5: Generated map and markers

The map is generated via Google play, a library for using Google Maps in the application. The library provides the `com.google.android.gms.maps.MapFragment` class and the `MapView` class for displaying the map component.[9] By making few additional information to the android manifest file, the google map can be easily implemented onto the application. By using the `onMapReadyCallback` and `Location` listener on the `mapactivity.java` file we showed the current location of the user. The database in PHP stores information about the individual marker locations like the name of the facility, address and geographic coordinates. The map retrieves this information from the database, through an XML file that acts as an intermediary between the database and the map. We have used PHP statements to export marker information from the database to an XML file.

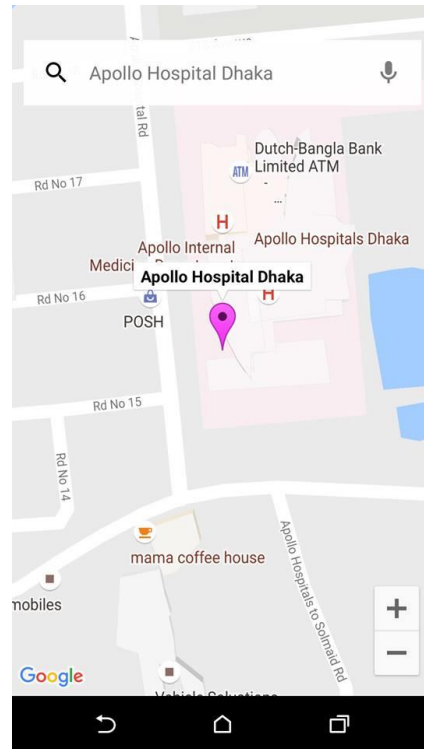


Fig 4.6: Showing the searched facility on map

First we designed a search bar which hovers above the map as shown in Fig 4.8. The search bar is designed using `LinearLayout`. When the search bar is clicked, it performs the `onClick` function. The `onClick` function triggers the search page above the map. For loading the search bar page, we devised a function called `loadFloatingBarSearch()`. The search bar page is displayed using `Dialog` interface window. There are two parts of the `loadFloatingBarSearch()` function, one is to load and display recently searched facilities with address and the other to display the relevant facilities as the user types something in the search bar. For the first part, we have used a special type of API interface of android called `SharedPreferences` to store and retrieve application references. `SharedPreferences` are simply sets of data values that stored persistently. Persistently

which mean data you stored in the SharedPreferences are still exist even if you stop the application or turn off the device. Here we have used SharedPreference to store the recent searches by saving the name and address of the facilities. In the loadFloatingBarSearch() function we have initialized two ArrayList of type String. One of the list is used to load the list of the name of the facility from the SharedPreference. The other list is used to load the consequent address of the facility from the SharedPreference. When the search bar page opens for the first time, the user would not be able to see any recent searches as the user did not search anything before, but afterwards as the user will continue to make searches, the next time the user will be able to see the recent searches in the form of ListView. For the second part, we created a custom search adapter which is used to display the search results (facilities and corresponding address of the facilities) in the form of ListView. In this adapter, the arraylist of facility name and address which is downloaded from the webservice is used to fill up the list items with the corresponding facility name and address. Then this list is shown to the user accordingly while the user types anything in the searchbar. We have also used a default function called textWatcher which is used to filter out the results according to the letters given input by the user. Finally onClick a list item, we match the item info with the markers of the map and filter out the correct marker and then zoom in function is called to show that specific facility which has been clicked from the search result.

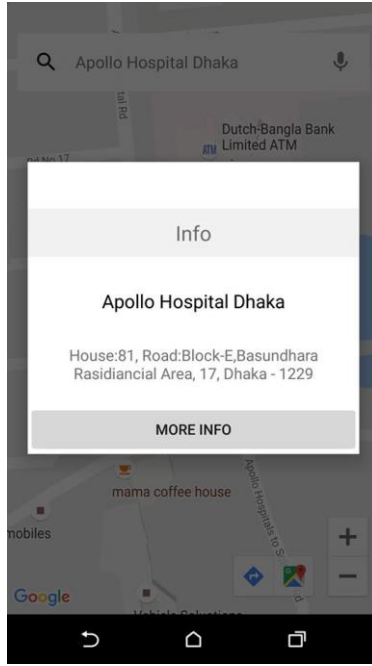


Fig 4.7: Brief information about the facility



Fig: 4.8: Detailed view of the chosen facility

When More Info Button is clicked, the specific facility id is passed to the next page using Intent putExtra function. This id is then received in the Facility Info page. Simultaneously, the facility informations are downloaded from the web server using the AsyncTask HttpClient. The data is downloaded as JSON array containing a lot of JSON objects. Each JSON object refers to a specific facility information. We extract each facility info from the JSON array and objects into separate Arrays using a loop. Each array contains the specific informations, like an array of Facility ID, an array of Facility Name, an array of Facility address, etc. Using the retrieved facility id from the intent that is passed down from the map page, we make a cross check with the facility ID array and save the index of that facility ID. Using this index, we then extract all the info about the facility from the other arrays and save them in specific parameters. Finally,

using those parameters we set the values on specific view objects and therefore display all the information available about that specific facility. Additionally, we used menu to navigate from one facility section to the other, and here as well, we pass the facility id to the other pages using Intent.putExtra function and the same process as mentioned above repeats.

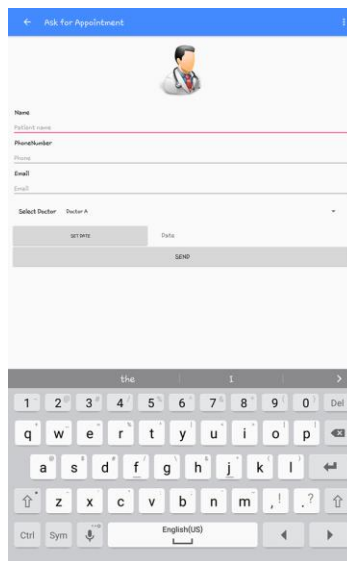


Fig4.9: Appointment System

At first we have designed the appointment.xml file in order to display the appointment activity with fields to take as input for patient name and email shown in Fig 4.9. We have kept a spinner that gives the option to choose which doctor the user wants to request appointment for, for example Doctor A , B or C. The user also needs to choose the date for appointment .

Patient Name	phone Number	Facility	Doctor	Approve
Debatina	012389	1403704200996	Doctor C	Approved
Debatina	1235688	1403704200996	Doctor D	<input type="button" value="Approve"/>

Fig: 5.0: Appointment list

The script is created to intake value that is submitted from the appointments form and then it has an approve button which is a field on the appointments table on the database named approve and the value of the field is zero initially and when approved it is turned to 1. This immediately sends out an email to the user as confirmation.

4.7 Results

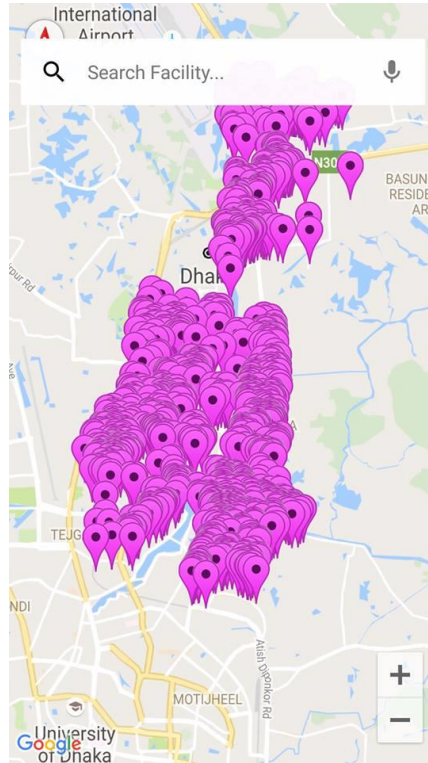


Fig: 5.0 Markers on Google Map

The main motive of this application is to show users their nearby healthcare facilities. According to the figure 5.0, we have successfully shown it. All the markers are the results of nearby healthcare facilities. It will also show the address of the healthcare facilities. The user can see further information about the particular facility. The user can also set appointment with a particular doctor and the user will get a confirmation email as well.

Chapter 5

Conclusion

As we have seen, our Urban HealthCare Facilities offers a dynamic and vigorous answer for the current healthcare situation that is in agreement to current practices and innovative progression. Having said that, there is extension to additionally form the framework into a much more grounded unit, while likewise making it more available and facilitating extensive scale utilize. A portion of the issues and works that can be done of the right now proposed framework, and finishing up comments are introduced beneath.

5.1 Conclusion

To conclude we have created a system that will help in the development of leading Bangladesh. HealthCare sector is very important for a developing and leading nation. Our project is not limited to this; we would like to take it further to make a bigger platform.

5.2 Limitations

One of the problems of our project is that when someone sets an appointment, anyone with the link of the phpmyadmin can access it to see the list of appointments. So basically it is not a secure platform. In near future we would make that we can take a secure platform to solve this issue.

5.3 Future Works

While the potential of the application and its supportive structure for users are apparent, there is a need for a review of the user interface of the application and introduce an interface with both bangla and english font for users. There are many more functionalities that would increase the

potentiality of the usefulness of the application. We also want to make the doctors appointment automated so that it can sort appointments by itself according to priority wise. Log in via social platforms which would increase the usage rate of the application. Due to lack of time, the features mentioned above could not be implemented however in future these areas of improvement should be explored.

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