My Doctor: Security, Payment Reporting and Online Pharmacy

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Inspiring Excellence

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Declaration

We, hereby declare that this thesis is based on results we have found ourselves. Materials of work from researches conducted by others are mentioned in the reference. This thesis, neither in whole nor in part, has been previously submitted for any other degree or any other publication. All the implementation has been and functionalities been use are done by ourselves.

Date: 10.8.2016

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Abstract

Our thesis is to create a system which is an online based medical system with extra facilities like report uploading, follow up at the same doctor, online pharmacy. In today's world if someone wants to take an appointment to a doctor needs to call in clinic/hospital or personally go at the place and make an appointment. This consumes precious time of the patient. Also if the doctor cancels his/her schedule, the patient does not come to know about it unless he/she goes to the clinic or hospital. Besides this, people living in major cities have access to quality doctors but struggle due to lack of free time and heavy traffic jam. But, people living in village don't even have proper medical facilities within their range. To minimize the problem, we are trying to develop an online system where patients can have quality medical service from qualified doctors all over the country. Doctors will directly communicate with patient via online. Problem a patient face because of being at far distance from city can be reduced. The objective of this project is to minimize the hassles peoples face during medications and also to introduce a system that will become a platform for new doctors. The patient will make an appointment through online and payment will be received through bkash. A hardware based system is connected with database that will crosscheck with all transactions submitted by users. The doctor will come to know the number of patients he has to attend whole day. Our system "My Doctor" will save patient's as well as doctor's time. It will save the receptionist's paper work. We have used data compression to reduce the amount of data and stored into file system. Previous records are being stored into the patients profile from where he/she can make new appointment to continue medication. Doctor can observe patients old record for more queries. Reports are being displayed with standard values to help doctor and standard values are collect from reliable source. Image report upload is also implemented in our system which will make easy for patient to describe the problem and easy for doctor to understand the situation how instance the matter is. Doctor can suggest other doctor directly from his panel based on his observation and problem of patient. An online pharmacy is to help out patients to provide medicines within a single account.

Acknowledgement

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List of Abbreviations

HTML	Hypertext Markup Language
CSS	Cascading Style Sheet
PHP	Hypertext Preprocessor (Scripting Language)
PDO	PHP Data Object
SQL	Structured Query Language
GSM	Global System for Mobile

Chapter 1

Introduction

User-created content and communication on Web-based applications such as networking sites, media sharing site, or blog platform and so on like this, have dramatically increased in popularity over the past several years, but there have been very little opportunities for online medical services in the digital world[1]. Sometimes we come across of small problems where we to need to consult doctors and physician about our health problems or for the nearest ones and follow their prescriptions. Sometimes we need to call to the clinic for appointment or personally go to book appointment[2]. This consumes huge amount of time of our daily life. Our "My Doctor" System will provide us the power of direct interaction between doctors of our choice as we as when required for our small problems. Using our system patients will need to fill up an online form in just few seconds before entering to the virtual office room. It will also enable patients to upload their lab results such as x-ray copies, reports, health history etc. which can be viewed by our highly qualified doctors. Our project is to build a health care system which will create a platform where doctor can easily reach to people from every corner. We chose to create online system as it is the best media to reach people very fast. We are planning for a system that will also create opportunity for new doctors. This system will have an algorithm that will do scheduling dynamically and load balance among doctors so that all have the same amount of work load. Doctors will communicate through online chatting which is controlled by a central server. Advance database method OLTP is being used to bring the best out of database. For the payment we are go using bkash which is now very much available in all the places in our country. The collected patient's information will be stored in the central database. The form is constructed through researching few good diagnostic centers and doctors. Before taking an appointment patient will have to fill up a form to take an appointment so the system will always have a track of patient's information and doctor can monitor patient profile. There is also an online pharmacy connected with the main site from where people can buy daily required medicines very easily. The pharmacy is open for all so those who are not registered user can use the pharmacy service. Our main objective is to develop a system where the patients can get their best treatment from the most qualified doctors within a very short period of time.

1.1 Objectives

- Secure registration and login process for user of the site. Single patient account information is used for both appointment and pharmacy purchase transaction. Account password will be kept encrypted. After all work in database is done connection will be kept close.

- Neither doctor nor patient can view each other's details. While they are connected they will have a view of id and no other personal information will be disclosed.

- Data should be kept hidden and well encrypted so even if there is a breach none of the data will be compromised

- Patient can upload various medical test reports into the site which will be stored into server. The documents are going to be saved as text file to save space.

- If any patient wants to take an appointment of a doctor from past visits, than a system which will keep record of old appoints. Using that information user can make appointment which many ongoing systems don't have.

- Doctor can look all previous reports of a patient if he/she has taken an appointment. Previous data will be displayed with reverence value, which will be collected from a valid and reliable source.

- Image report like x-ray can be uploaded into the site. Image size will be compressed using algorithm.

- A hardware system which will update database if it gets any payment from user. The transaction id will be stored into database and after every 5 minute it will automatically check if user also uploaded same transaction id. Confirmation of payment will be done by use of this hardware system and database.

- Same patient account can be used to buy medicine from online store. User don't have to login with two different account.

- Doctor can recommend user to a new doctor and make schedule from his panel.

- An online medicine shop which will also do home delivery the order.

1.2 Motivation

People suffering from lack of quality health service are nothing new in our country. There was a time when the death rate of our country was high just because there were not enough doctors compared to the demand. Though, with time, this situation has developed, people still has to suffer to get quality medical consultation. In many cases people has to suffer for a long time or even die of health problems that could be easily cured with a little guidance from a quality doctor.

People living in major cities have access to quality doctors but struggle due to lack of free time and heavy traffic jam. Over that people need to go through this hassle multiple times. They need to make the appointment first. Then they have to be present in the doctor's chamber another day. After that, if they are suggested to do some tests on them, the patient of someone related to him has to come to the doctor once or a few times again. Even after all of these many cases needs multiple visit to the doctor for regular checkups, which is just recurrence of all those hassle just mentioned.

People living in village don't even have medical facilities within their range. They usually need to go to nearby bigger towns or city to visit just a certified doctor. Sometimes they need s to travel for a few hours to the doctor. Which is not only a waste of time; it's often a big problem to the patient who is already in a great pain. Let alone the painful process of getting an appointment first and waiting for the turn to see the doctor.

To wipe this problem there exist some online health care system. Those services are mostly static and health-blogs and only doctors contact databases. Where health blogs are a great way to get information and tips of the common problems that most people have, it's at the same time, is a big source to get false, unverified or misleading information which can lead to slow curing or in the worst case, even worsening of the problem, as they are not written by or verified by any qualified doctor or medical person. Over that, many people don't feel private enough to post on blogs about their sensitive issues that they don't want to be read by numerous people.

There are very few health services who actually offered over-phone doctor consulting services. The main problems with those services are, they don't keep any track of their patients. Once a patient hang up the phone after consulting to the doctor, there's no guaranty he or she will speak to that same doctor again. This is a big problem for health issues like pregnancy where it's essential to stay under continuous observation of one specific doctor. Over that those services don't let doctor any way to review patient's medical reports for further detailed consultation.

1.3 Scope of Thesis

In our thesis, we propose an online health care system where patient can take an appointment online, directly communicate with doctor online on that given date and time, upload any required medical test reports to the doctor and consult to the same doctor multiple times in future if needed. There will be an online registration process, dynamic scheduling and rescheduling process for the patient for their further appointment. The patient's information will be kept safe and not visible to everyone and last but not the least, there will be a safe and secure payment method in our system. The above mentioned terms have been elaborated later in this paper.

1.4 Features

Our system will have quite a few features both for the patients and the doctors. The system that we are implementing is a web based service. Any person can use this from any type of device that has a web browser.

First of all, both types of users will have a registration and login option. Patients can open an account by registering from the website and the use the credentials to login and use all other features. After logging in, a patient can proceed to take an appointment from a doctor by providing his or her preference information. After making a successful appointment, the user can consult with a doctor at that appointed date and time slot.

There's also option for uploading medical reports by manual text input and by uploading image file of reports that are based on images such as x-rays and ultrasonography.

The patient will receive medication by the doctor and if he or she wishes, there is also an online pharmacy to order prescribed medicine to be delivered home.

On the doctor side, doctors will get their account from the admins of the website after officially registering as service doctor up on verification. The doctor can communicate with the patient and prescribe him medicine and even suggest to do medical tests if required.

1.4 Thesis Outline

Chapter 1 is the formal introduction of the thesis. We have discussed our motivation, scope, features and objectives.

Chapter 2 is the background study we did before starting to implement the system.

Chapter 3 is focused on the design and architectural view behind our project

Chapter 4 is the detailed information about our system specification. It is focused on the tools we used to implement the system and the reasons and benefits behind them.

In Chapter 5, we talked about the implementation process in details.

In chapter 6, we have talked about the result and analysis part which includes cost estimation and website analysis.

In chapter 7, it mentions about the conclusion and the future aspects of our thesis project.

Chapter 8 is the references and citations.

Chapter 2

Literature Review

2.1 Existing System

The manual health care system that we have in our country, at first we have to wait in long line to take an appointment for the doctors and wait even longer for our time to meet with doctors and discuss on our health problems. Besides this we have to provide our reports and others information in many different places such as medicine store which is always a burden. And most importantly keeping all the work, we have to present physically at the doctor's cabin [3]. To wipe the problems, there exists some online health care system. These systems are mostly static health-blogs and have only doctor's contact databases. Using those blogs people can learn about various health tips, but there are very few services who actually offer online doctor consulting services. Our project is to build real world doctor patient relation via internet. Available services only offer static or limited help to patients. We have analyzed many online services and found many related sites which were helpful for our project. We have studied their database structure, payment methods and profiling of patients. Results which were related to our topic are discussed below.

2.1.1 Grameenphone Health Care Service

We researched on Grameenphone healthcare system and came to know that with the help of Telenor health, they have launched a free health service named "TONIC". To ensure the well-being of the people. It will bring a master plan of staying well. Tonic members will get free health tips, free discount of hospitals and affordable access to the doctors through their mobile phone [4]. In our system we also have messaging system in addition with this we also keep free health tips to the patients who have appointed once. Grameenphone health care system provides health care to the patients but the service is available only for one session. If any patient wishes to call back for a feedback, they have to start from the initial point. Another disadvantage of Grameenphone health care service is that they never keep records of the patients for the future. Because of that the patients who get treatment from a specific doctor first time never get him/her for the second time or more. Two doctors may not have prescribed same medicine for the same diseases. So, the patient often suffers from proper treatment. Here, in our project we want to establish a database system where we will keep all the records such as doctor's name, patient's name, appointment date, payment, next appointment along with standard test results. This makes it easy to keep

track for a patient in his/her next appointment. In GP health care system there is one system that if any GP customer is a star subscriber he/she will get privileged to get appointment earlier. But in our system we do not have any discrimination. Those who will login to our system first will get the appointment first.

2.1.2 Doctorla

We did our research on Doctorla a well-known website in our related field and gathered knowledge that they only keep doctors list in their system and in the booking page they have the doctor's name, doctor's appointment date, time and available area they use Google map for this [5]. But in doctorola.com we do not find any second appointment system in their system. They also do not have any system for the patients to contact with the doctors directly. They do have a help line number that is 16484 (Everyday 8.00am to 10.00pm). But one can never get to the doctors directly through that number. In our system one can get to the doctor directly through online chat server. They also do not keep any record of the patient. But in our system we will have a patient profile in our database with all the records and separate visiting logs. To make our project unique and more helpful as well as useful here, we plan to set an online chat server through which patient can talk to the doctor from the remote corner of our country using internet. We also have planned to implement a video chatting system in our project by which patient can consult with the doctors directly, which we never find in of the existing health care system.

2.1.3 Webhealthcentre and Pinkhealthecare

Websites like Webhealthcentre [6] and pinkwhalehealthcare [7] also offers health care services. After studying those sites we found that they also provide pretty similar type of care like Gramophone health care and doctorola.com to the patient. But main drawback is that none of them provide second appointment as this is the first priority of our project. Among all the health care system we never find any system that they provide Ambulance. But in our project we will have a system that will let the patient know a shortest distance of available Ambulance in they need in emergency. This is one of the unique parts of our project.

2.1.4 BDhealth

We surfed on the BDhealth and learned that they provide health care like all the other health organization but in more constructive and organized way. They have all the doctors booking and appointment system like others, emergency services, healthy living tips and hot line number [8]. But like other health care blogs they also do not have any second appointment system and direct communication with the doctors

for the patients. A direct communication over phone can save a patient's lot in time and convenience which is the main concern of our project.

2.2 Image and Data Compression

Patient has the privilege to upload their report as txt file. The system requires image uploading and display to identifying various problems of patients. Patients can upload image format of various reports and can be viewed. The problem is that we are keeping the data into our server, if the image is too large then our server will be very bulk. So we need to compress the image and then upload it into the site. The advantage of a good compression algorithm is to reducing data size without harming the actual data. PHP gives the advantages to use their building methods to reduce the size of image [1]. Firstly we have to get the type of the image from the actual image using the getimagesize() method of the PHP. The method will fetch the dimension of the image. Then the format of the image was fetched using method and using the format of the file. Three types of file are support for the next step. Other Methods will be declined from the entry and Error message will be displayed to the user.

imagejpeg ($source_image, $destination_image, $quality)

The method imagejpeg() will be used to compress only the JPEG image. Like the JPEG, PNG image is converted to the new size.

2.3 A Hardware System for Database

We have designed an arduino based hardware system connected with a gsm module which will receive bKash payment and be able to update the information of the transaction into the database. The system will be handled with python and the database for the system will be used sqlite. User will send money to provided bKash number. Our hardware system will be attached with a computer and will update every transactions received by it. When it receives a message it will crosscheck with the standard bKash format and if the format matches with the standard one than database will be updated. We will use this system to verify user's payment. The system will check if any user has uploaded the same transaction code it has in the database. If the transaction id matches than patient will go ahead with the appointment.

Chapter 3

System Specifications

3.1 PHP

PHP is a server-side scripting language basically designed for web development purpose. It is imperative, functional, object-oriented and reflective. PHP stands for Personal Home Page. It was designed by Rasmus Lerdorf in 1994 and later on developed by The PHP Development Team. PHP is largely used language to develop websites. It can be embedded into HTML code and can be used combination of different kinds of web templates and framework [10].

Fig 3.1: Logo of PHP.

We can manipulate data using PHP. To create the best website we need PHP because PHP helps to give the best view of the images of the website. PHP is helps to embedded HTML codes. We have used some HTML codes to build our project.

3.2 HTML5

HTML stands for Hypertext Markup Language. It is the most standard markup language for creating web pages and websites. Using CSS (cascading Style System) and Java script, HTML forms the basis of World Wide Web. Inclusion of CSS defines the outlook and layout of the content and the inclusion of Java Script control the behavior of the content. The goal of HTML is to provide the most beautiful and complete guideline to create web pages anywhere. HTML elements are like building blocks of HTML pages. HTML instructions are described by HTML tags such as <img/> and <input/>. The latest version of HTML (HTML5) was published in 28 October 2014 by the World Wide Web Consortium (W3C) [11].

Fig 3.2: Logo of HTML5

We have used the latest version HTML5 to build the basic structure of our project. We have used HTML to create contains of the tables. In our project we have multiple tables and in those tables there are different data and images. To insert those images and data we have used HTML5. Along with HTML we have used CSS and Java script to develop our project. We have used CSS basically to define the outlook and create the layout of our project.

3.3 CSS

Cascading Style Sheets is called CSS. It is very important to build a website not only works well but also looks well. CSS is used in to give a basic HTML web page a modern look. With the help of CSS input and output can be designed at different shapes and forms. CSS is used to stylize web page also reason to make user interaction with website more amusing and colorful. CSS style sheets can be linked with any site with the addition of <link> tag at the <head> tag of HTML code. Or in place styling can be done within a html tag.

Fig 3.3 Logo of CSS

Using the CSS we have designed a free and fluid navigation bar. The navigation bar holds its position and ratio in any devices. Input formats like textbox, password fields have been given modern look using CSS. With the help of style sheets different fonts are linked with the site and can be easily displayed. Border margin, padding and other commands like float controls the flow of the page. Images are displayed with different view angle and style with the help of style sheet.

3.4 XAMPP

XAMPP stands for Extensible Messaging and Presence Protocol. It is widely used communication protocol that is free and runs on open source cross platform. It was developed by Jermie Miller in 4th January 1994. XAMPP server uses a client-server network. XAMPP is largely used temporary servers by the developers to run their web applications. Like all the other instant messaging protocol, XAMPP is being used as an open source and open standard system to develop any applications. Anyone can implement XAMPP services and incorporate with other organizations implementations. It uses a local host with the IP address [12]. XAMPP makes a personal computer to a local server.

Fig 3.4: Logo of XAMPP

XAMPP has built-in Apache. Apache provides local server. We have used XAMPP Apache to use local server for our project. XAMPP has built-in with PHP My Admin. We have used XAMPP PHP My Admin to run our PHP codes. We have bunch of PHP codes so we used PHP My Admin to run those codes correctly. To run the codes we have to use htdocs, we have also created many htdocs folder to create our project. We have created many sub domain folders using htdocs. This things are build-in available in XAMMP. So, we have used the latest version of XAMMP to run our project as a local server.

3.5 MySQL

MySQL is mainly an open-source relational database management system. It is the world's most familiar open-source database. It was founded by Widenius and Axmark in 1994 and developed by a Swedish company MySQL AB. For its excellent performance, proven reliability and ease of use, it has become the world's leading database choice to web developers. Many high profile Web Companies including Facebook, Gmail, Twitter, YouTube, Yahoo and so on like this use the MySQL database system[13]. We also used MySQL database to develop our project.

Fig 3.5: Logo of MySQL.

3.6 000WebHost

00Webhost is a free web hosting domain that is being used throughout the world. A free website hosting is a non-paid hosting service that provides forced ads on to the subscriber's website. It usually provides a sub domain or a directory. It is safe, free and easy to launch web site. So, we have used 000WebHost for initial testing of our project.

Fig 3.6: Logo of 000WebHost.

3.7 Google Chrome

Google Chrome is the most popular widely used search engine throughout the world. It is an open-source web browser and a product of Google. The name comes from the graphical user interface frame or chrome of web browsers. Chrome prevents malware from installing automatically. So, it is safe to use than other web browsers. It also gives high speed compare to other browsers. So, we have used the latest version Google Chrome for testing our application.

Fig 3.7: Logo of Chrome

3.8 Mozilla Firefox

Mozilla Firefox is also a very popular search engine throughout the world. It can work very well in all operating system. Mozilla Firefox was developed by the Mozilla Corporation itself. It was made simple, easy and safe to use for the users. So, we have used the latest version of Mozilla Firefox as a second option to run our project.

Fig 3.8: Logo of Mozilla Firefox

3.9 FileZilla

FileZilla is widely used software to transfer files to FTP, SFTP encrypted FTP and so on like this. It is free software, open-source cross platform application. It was developed by Tom Kosse and two of his classmates as a computer science class project in January 2001. It is very easy to use. So, we have used FileZilla to upload our files and properties.

Fig 3.9: Logo of FileZilla

3.10 Python

Python is one of the largely used high level and dynamic programming language. It emphasis on code readability and its syntax structure gives opportunity to the programmer to express their ideas in fewer lines than C++, C and Java languages. Java and C++ programming languages number of lines of codes to express a simple concept such as addition of two numbers whereas Python uses fewer lines than Java to express the same addition. It supports multiple programming patterns such as object-oriented, imperative and functional programming. Python was first designed by Guido van Rossum and later on developed by Python Software Foundation.

Fig 3.10: Logo of Python

3.11 Arduino

Arduino is an open-source electronics platform based on simplicity and easy to use hardware and software. Arduino boards are capable of doing various kinds of things such as it can read input, light on a sensor, a finger on a button and turn them into an output. The boards feature interfaces are included with USB ports on some module for loading programs from personal computers. The design specifications are openly available that allows users to manufacture by themselves. The Arduino project originally started at the Interaction Design Institute Ivera in Ivera, Italy. Arduino has been used in thousand of different project and applications because of its simplicity and accessible user experience. It is very for the beginners and flexible enough for advance users.
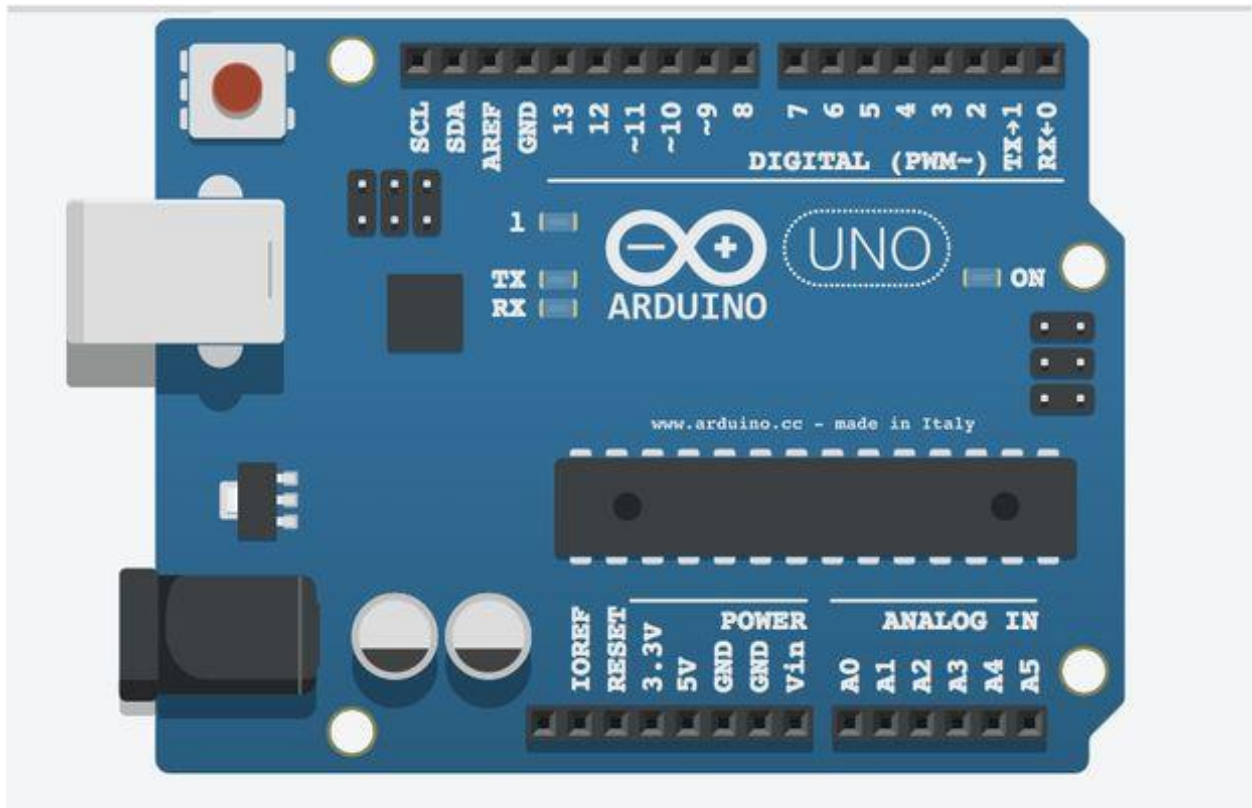
Fig 3.11: An Arduino

3.12 SQLite

SQLite is a relational database management system that is built with C programming library. It is not a client-server database management system. It is an embedded system incorporate with the end program. Among all the features the most important features are Transactions, Zero-configuration and Full-featured SQL. Its transactions are atomic, consistent, isolated and durable. The other feature is Zero-configuration that means no setup or administration is needed. SQLite is a full-featured SQL implementation had been used with advanced capabilities. It is largely used software in Database for the Internet of Things, Application File Format, and Website Database and so on like this.

Fig 3.12: Logo of SQLite

3.13 GSMShield

For GSM communication we used a SIM900a mini GSM module. SIM900a is an ultra-compact and reliable module. The SIM900a is a complete dual-band GSM/GPRS module in SMT type which is designed for low cost GSM communication. It communicates with controllers via AT commands. It is powered by 5V & works in a low power consumption mode where it consumes only 1.5mA on standby mode and has an operational temperature of -40°C to +85 °C. This module works with UART communication protocol.

Fig 3.13 Logo of GSMShield

4. Implementation

4.1 Use case diagram

A use case diagram is a graphic depiction of the interactions among the elements of a system. A use case is a methodology used in system analysis to identify, clarify, and organize system requirements.
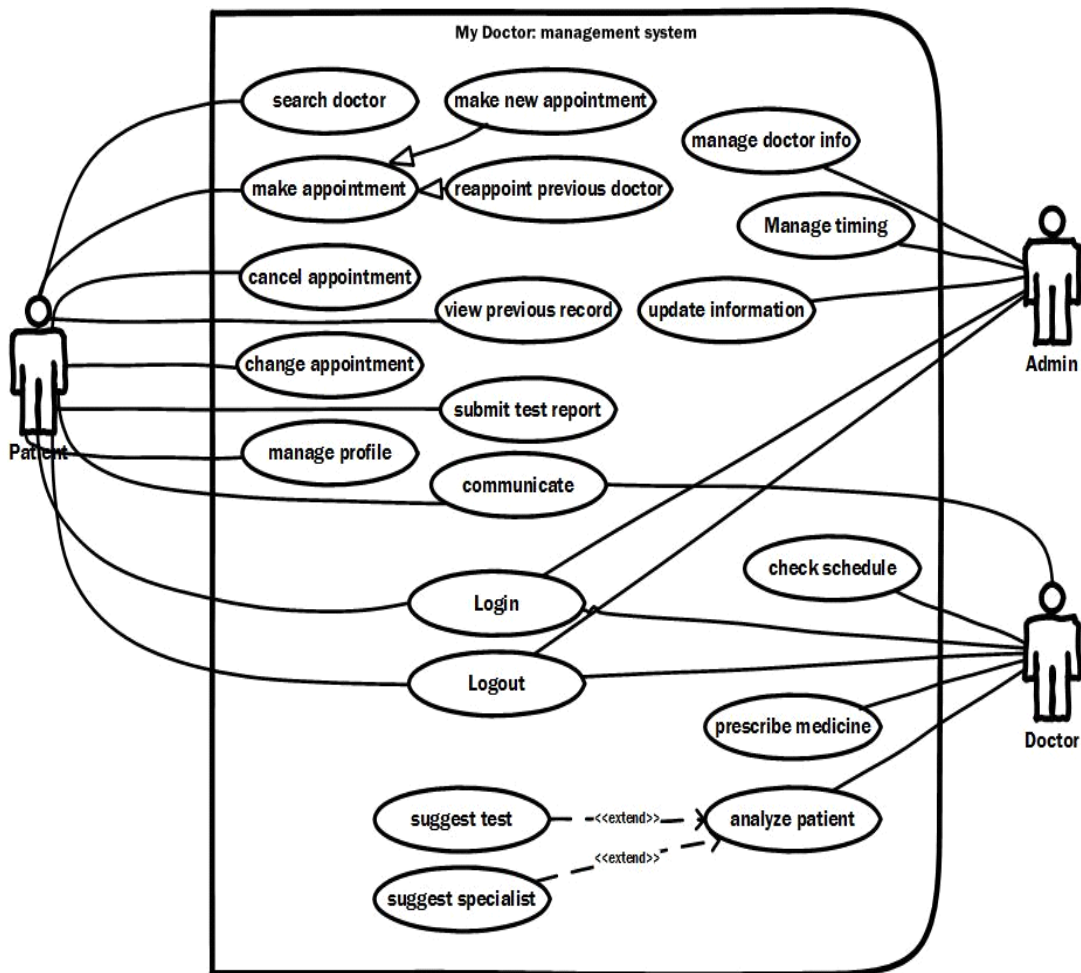
Figure 4.1: Use Case Diagram

Here, in our system there are three actors who will be able to access the system. They are admin, doctor and patient. All of them will have to log in with appropriate information. Admin will be

able to see all the information and activity of the system. He can also update any information including adding or discarding a doctor and timing slot modification. Doctor will be able to check the timing and the information about the patient he is being assigned to. Doctor and patient will communicate through an internal chat server. If any test or specialist in other sector is needed the doctor can also suggest that to the patient otherwise he will prescribe medicine accordingly. Doctor and patient will be able to update their personal information. After logging in the patients will be able to select any specific medical sector and request for an appointment. He can either a new specialist or choose the previous one with whom they already consulted.

4.2 Software Implementation

4.2.1 Basic Website Development

The system itself is a web based with mobile and standard web view. The initial skeleton has been build using HTML [1] and styled with CSS[2]. HTML is used to construct different variants like tables, buttons, image etc. With the help of CSS, we have given more life to the website. Use of html and PHP only can build up the page and the logic where without the CSS looks of a modern webpage cannot be possible. The logical operations were handled using latest PHP. We have used PHP 7.0.* which gives support to maximum in build functions. From the connection to sessions all are created using and handled with the help of PHP. Sessions which is needed to manipulate data is created using PHP. Different types of data structures like array, sessions and global variables [3] were used to create algorithm for our site.
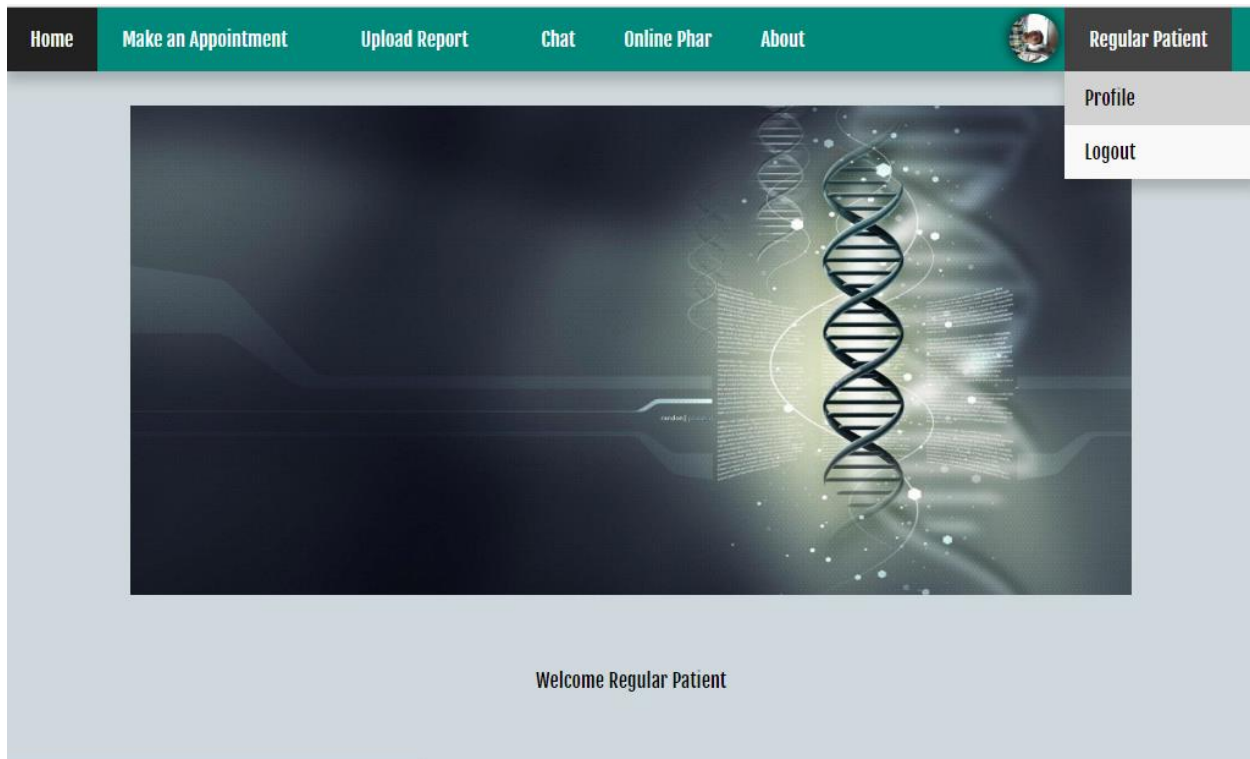
Fig 4.2: Basic Website View

Javascript is also used to manipulate page with user interactions. Various error massage and visual effects were brought up using javascript. Some alert messages that user needs to notice immodestly are delivered through javascript. The Opening image slide view is consist of javascript and some basic level of CSS.

4.2.2 Connecting Database with System

Website connection with database is handled using PHP's in build function PDO[4]. PDO offers maximum security with more advanced functionalities than MySql and MySqli. Initially a localhost server was created using XAMP where SQL server is created automatically and website was build and tested. Database of the site has three different tables and are:

- Department of work
- All user table
- Daily Schedule tables

Different types of department were classified into one table named 'dept'. The table breaks up into two parts firstly patient and other is doctor. Different types of doctors are also has been inserted into the table.

Basic information like name, password, phone number etc. is kept inside the user table. Time of a user registration all information are kept inside the table and at the time of login those information were used to identify a used. Everyday schedule was kept under different table where a row represents doctor and columns represent time.
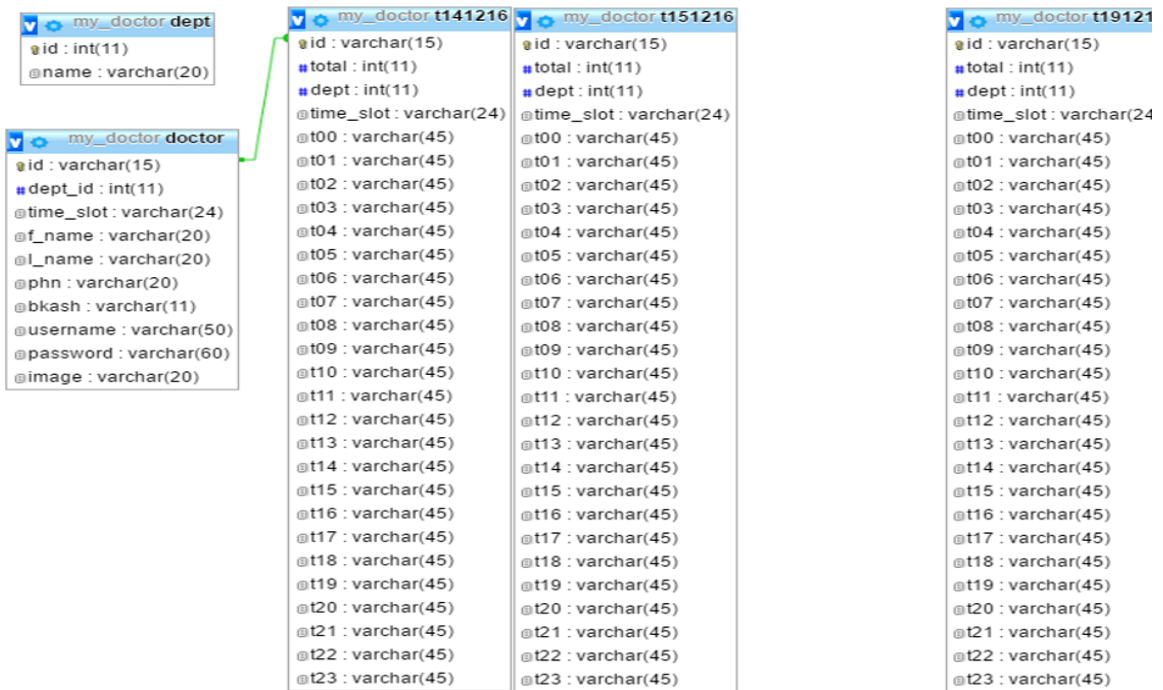

Fig 4.3: Designer View Database Table

dept

Column	Type	Null	Default	Links to	Comments	MIME
id *(Primary)*	int(11)	No				
name	varchar(20)	No				

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Keyname	Type	Unique	Packed	Column	Cardinality	Collation	Null	Comment
PRIMARY	BTREE	Yes	No	id	9	A	No	

doctor

Column	Type	Null	Default	Links to	Comments	MIME
id *(Primary)*	varchar(15)	No				
dept_id	int(11)	No	0			
time_slot	varchar(24)	No	0			
f_name	varchar(20)	No				
l_name	varchar(20)	No				
phn	varchar(20)	No				
bkash	varchar(11)	No	-1			
username	varchar(50)	No				
password	varchar(60)	No				
image	varchar(20)	No	default.png			

Indexes

Keyname	Type	Unique	Packed	Column	Cardinality	Collation	Null	Comment
PRIMARY	BTREE	Yes	No	id	20	A	No	

Table no 4.1: Database Structure

Tables are created using MySQL and all tables are designed in such way that multiple data entries are negligible. The database is designed with almost no dependency. In database Each day is represented using different tables and regularly updated using cronjob feature. Total number of patients, ids of patients are represented in such way that database will have less variables and more data to store. Default values and different variable types are used to get more use out of each table. To construct connection between two or more tables foreign key is being used.

4.2.2.1 Secure Register using password_hash method

To use the facilities of our site every user needs to register and login to the site. Our system needs a security that will keep users information safe. PDO database connection has an inbuilt method call 'password_hash()' which is a hash method to modify string PASSWORD_BYCRYPT is use to standardized the format of every password. Password hash method uses salt and hash technique where it runs hash method to change password format.
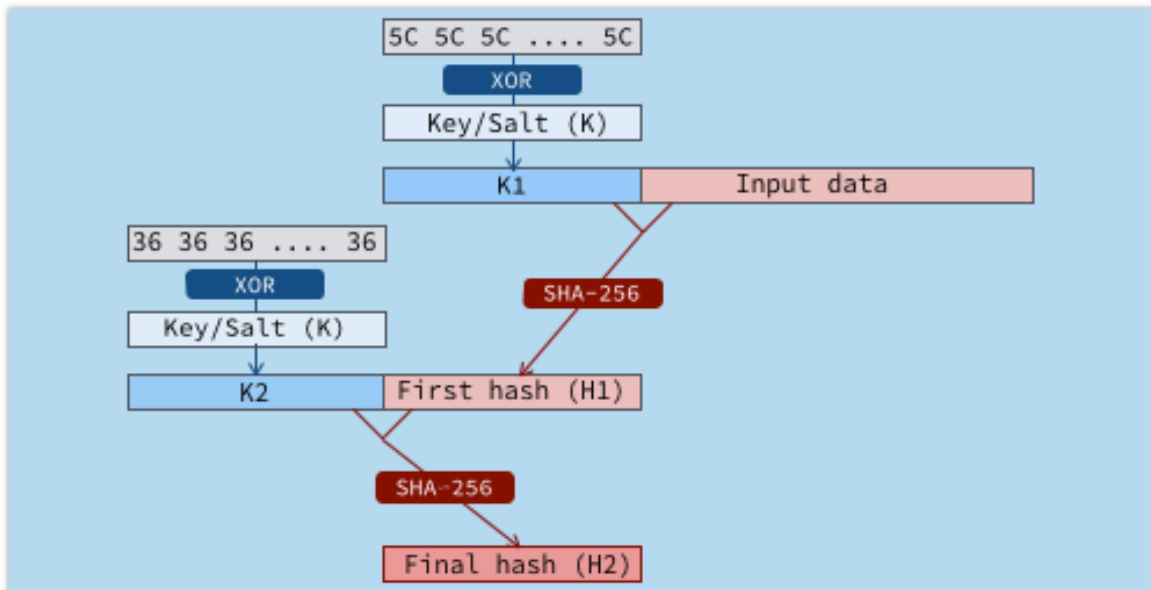

Fig. 4.4: Password Hash Function

Unlike an encryption password hash method don't requires hiding mod symbol. Using salt and hash a simple password will be converted into a long password maximum length of 75 letters. The hash method output can be manipulated using different hash sign which will change up outlook of hashed password. In password hash function the third parameter is used to initialize custom hash function. Using the third parameter input string is hashed to produce new result[8].
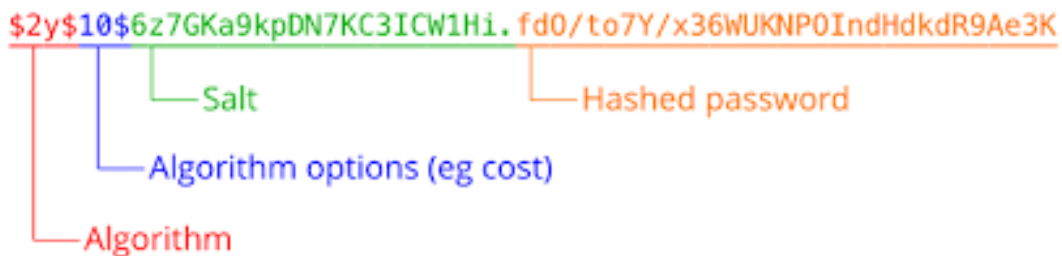
4.2.2.2 Login using password_verify method

When a user tries to login into his/her account has to insert password. The database class takes user email id and check inside the table for a match. If it cannot fetch any result than the user has inserted a wrong email id or don't have registered yet. For any wrong insertion a massage has been displayed into the screen so that user can identify the error and act according to that. On the other hand if database quarry can fetch data from the user table than password verify method is used to match user input password with the fetched password with the table. The fetched password is hashed which needs to be hashed again to get real string back. The function password_verify takes two parameters first one string input and second one is the hash function [9].
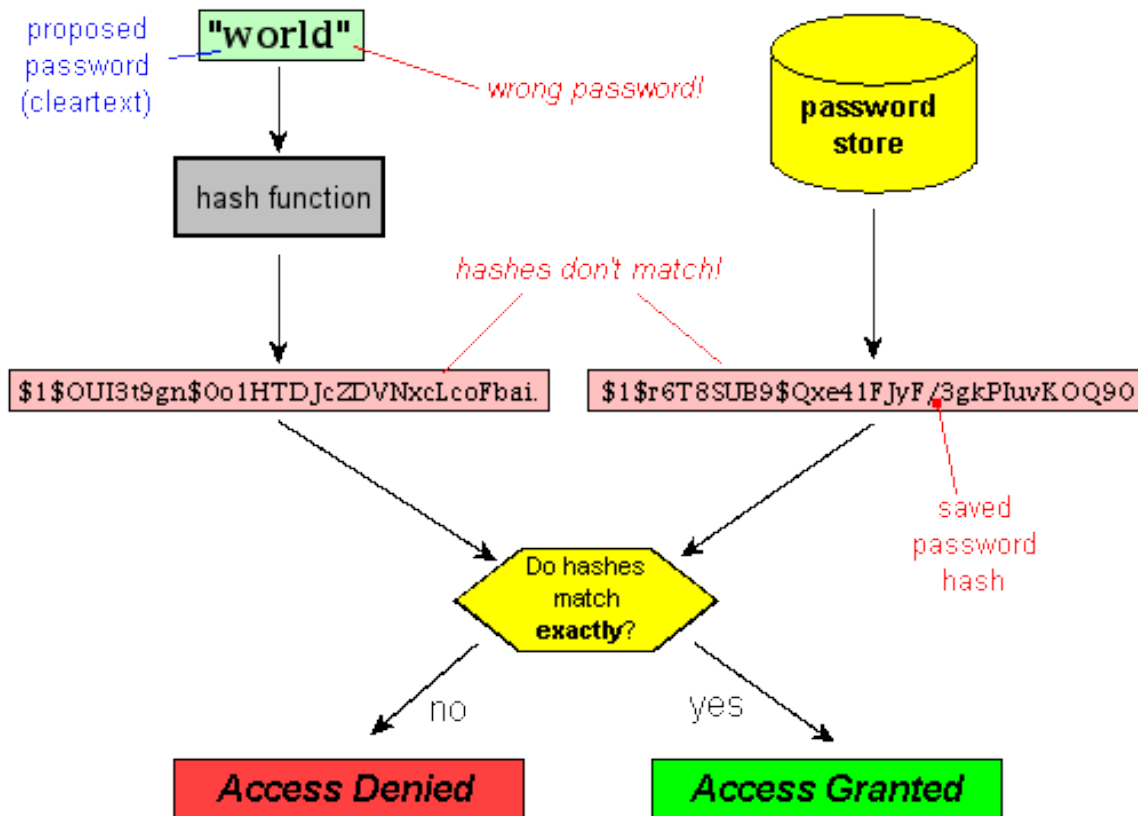

Fig. 4.6: Verify Password for Login

The internal function of PHP automatically decrypted hash and generates string and check with the input string. Then the fetched password is compared with the password provided by the user. With the help of

match function two passwords is matched. If two string matches than the method returns true or return false if two string do not match.

4.2.3 Data Compression for Site

Image report of patients is file of huge size. Managing that amount of space is very difficult. To minimize the size of the file and maximize the space of the server image compression code is being used. Using the algorithm we can control the quality of the image.

```php
<?php
function compressImage($image,$imageTemp,$ext,$path){

    if(   $ext=='png' || $ext=='PNG' ||
        $ext=='jpg' || $ext=='jpeg' ||
        $ext=='JPG' || $ext=='JPEG' ||
        $ext=='gif' || $ext=='GIF'  )  // checking image extension
    {
        if($ext=='jpg' || $ext=='jpeg' || $ext=='JPG' || $ext=='JPEG')
        {
            $src=imagecreatefromjpeg($imageTemp);
        }
        if($ext=='png' || $ext=='PNG')
        {
            $src=imagecreatefrompng($imageTemp);
        }
        if($ext=='gif' || $ext=='GIF')
        {
            $src=imagecreatefromgif($imageTemp);
        }

        list($width_min,$height_min)=getimagesize($imageTemp);
        // fetching original image width and height

        $newwidth_min=350; // set compressing image width

        $newheight_min=($height_min / $width_min) * $newwidth_min; // equation for compressed

        $tmp_min = imagecreatetruecolor($newwidth_min, $newheight_min); // create frame  for

        imagecopyresampled($tmp_min, $src, 0,0,0,0,$newwidth_min, $newheight_min, $width_min,
        $height_min); // compressing image

        imagejpeg($tmp_min,$path.$image,80); //copy image in folder//
    }
}
?>
```

Fig 4.7: Image Compression Algorithm

In this method there are four parameters first one is the image itself, second one is the temporary file created inside the server due to $_FILE method, third one is the file extension and last one the path where

the image will be saved. The method takes an image and resizes it according to max width or length. Then using that scale whole image file is formatted. Than the new image file is copied into the destination folder provided in the parameter.

4.2.4 Patient Report Management

My doctor service has its own report upload service. Various type of standard repot format are collected and provided at website. To upload a report into the site patient have to select any type of from. Empty boxes with reference values are given there to help the patient as well as doctor. Filling up the report patient has to check the box and press submit to upload.

Hematology Report From
Please donot fill up unknown fields

Test	Result		Reference Value
Hamoglobin	12	g/dL	F (11.5-15.5), M (12-12) g/dL
ESR(Westergren Method)	35	mm/hr	Men <50 Y:<15>50 Y:<20; Woman <50 Y:<20>50 Y:<30
Total Count			
RED Blood Cells	5.1	X10e6/uL	F(3.8-4.8) M(4.5-5.5) X 10e6/uL
Plateles	335	X10e3/uL	150-450 X10e3/uL
WHITE Blood Cells	10.2	X10e3/uL	Adult 4.0-11.0; Child(Birth-1mon):6.0-36.0 Child(6mon-3yrs):6.0-17.5; Child(4-10years):5.5-14.5
Differential Count			
Neutophil	35	%	40 - 75%
Lymphocyte	36	%	20 - 50%
Monocyte	9	%	02 - 10%

Fig 4.8: Report Upload

Storing reports into database may cause heavy traffic for single database. So we chose to store data like report payment details into our server. To access inside folder u have used php function file_put_contents()[10]. The function itself takes three parameters first one is destination of file which will be written, next comes in the string which will be written into the file and at the very end comes style or

format, we have used APPEND format as we have multiple line into our reports. After getting all the valid information PHP runs the method to write into the file a string provided through the parameter.


```php
if(!empty(@$_POST['agree'])){
    date_default_timezone_set("Asia/Dhaka");
    $folder = $_SESSION['user_id'];
    $file = "../upload/report/$folder/r_hematology".date("y_m_d_hm").".txt"

    $write = makeString();

    file_put_contents($file, $write, FILE_APPEND);
}else{

}

?>
```

Destination
String to Write
Store Style

Fig 4.9: File Upload using file_put_contents method

If the destination file do not exists than the method generates error. Another custom method named makeString is used here to construct string form the user input. All input provided by user are collected using $_POST [11] method and then using appending whole format report has been created alongside the standard values.

```php
function makeString(){
    $str = "";

    if(!empty($_POST['hamo'])){

        $str = $str."Hamoglobin : ".$_POST['hamo']." ref:[ F (11.5-15.5), M (12-12) g/dL ]\n";
    }

    if(!empty($_POST['esr'])){

        $str = $str."ESR : ".$_POST['esr']." ref:[ Men <50 Y:<15>50 Y:<20; Woman <50 Y:<20>50 Y:<30 ]."\n";
    }

    if(!empty($_POST['rbc'])){

        $str = $str."RED Blood Cells : ".$_POST['rbc']." ref:[ F(3.8-4.8) M(4.5-5.5) X 10e6/uL ]."\n";
    }


    if(!empty($_POST['plate'])){

        $str = $str."Plateles : ".$_POST['plate']." ref:[ 150-450 X10e3/uL ]."\n";
    }


    if(!empty($_POST['wbc'])){

        $str = $str."WHITE Blood Cells : ".$_POST['wbc']." ref:[ Adult 4.0-11.0;<br>Child(Birth-1mon):6.0-36
            Child(6mon-3yrs):6.0-17.5;<br>Child(4-10years):5.5-14.5 ]."\n";
    }

    if(!empty($_POST['neuto'])){

        $str = $str."Neutophil : ".$_POST['neuto']." ref:[ 40%-75% ]."\n";
    }

    if(!empty($_POST['lympho'])){

        $str = $str."Lymphocyte : ".$_POST['lympho']." ref:[ 20%-50% ]."\n";
    }

    if(!empty($_POST['eosin'])){

        $str = $str."Eosinophil : ".$_POST['eosin']." ref:[ 1%-6% ]."\n";
    }

    if(!empty($_POST['beso'])){

        $str = $str."Basophil : ".$_POST['beso']." ref:[ < 1%]."\n";
    }

    if(!empty($_POST['pcv'])){

        $str = $str."P.C.V (Hct) : ".$_POST['pcv']." ref:[ F: 37-47%, M: 40-52% ]."\n";
    }

    if(!empty($_POST['mcv'])){

        $str = $str."M.C.V. : ".$_POST['mcv']." ref:[ 82-10fL ]."\n";
    }

    if(!empty($_POST['mch'])){

        $str = $str."M.C.H. : ".$_POST['mch']." ref:[ 27-32 pg ]."\n";
    }

    if(!empty($_POST['mchc'])){

        $str = $str."M.C.H.C. : ".$_POST['mchc']." ref:[ 30 - 35 g/dL ]."\n";
    }

    if(!empty($_POST['rdwcv'])){

        $str = $str."R.D.W.-C.V. : ".$_POST['rdwcv']." ref:[ 11.60 - 14.00 % ]."\n";
    }

    if(!empty($_POST['rdwsd'])){

        $str = $str."R.D.W.-S.D. : ".$_POST['rdwsd']." ref:[ 39.00 - 46.00 fL ]."\n";
    }

    return $str;
```

Fig 4.10: makeString method of file upload

4.2.5 Make Appointment from Previous Record

One of the key features of our project is to overcome the drawbacks of existing systems. Grameenphone's health care system has almost same approach but has no follow up system. Here in our system patient can chose to continue his/her medication with one of their previous doctors. To construct such a system, we went back at the time of registration. At the time of registration our system automatically creates a folder with the same id of new registered user. In that folder a txt file is saved to hold up the record of each appointment.

Fig 4.11: The text Record File for Appointment

Custom method called set data is used to construct a view for patient who reads from the appointment file and constrict list of all appointments and converts the raw data into human readable data.

```
/***
 *
 **/
function setData(){
    $user = $_SESSION['user_id'];
    $folder = "./upload/report/$user/appointment.txt";
    $file = fopen($folder, 'r');
    $i = 0;
    while(!feof($file)){
        $str = fgets($file);
        $doc[$i]= substr($str, 0, 12);
        $dept[$i]=substr($str, 13, 1);
        $time[$i]=substr($str, 15);
        $i++;
    }
    fclose($file);
    $data[0]=$doc;
    $data[1]=$dept;
    $data[2]=$time;
    return $data;
}
```

Fig 4.12: Reading the Appoint file using setData method

After every appointment details of the appointment is stored into the text file. Using that file user can the date of appointment and department of doctor. So the information helps user to remember about the appointment. Any personal details about doctor like name, phone or mail address will be kept hidden. From that menu user can make an appointment if the doctor has free schedule of the next day.

Select	Department	Time
○ none		
○	ENT	16/11/22 00 PM
○	ENT	16/11/22 00 PM
◉	Nutrition	16/11/22 00 PM
○	Nutrition	16/11/22 00 PM
○	Nutrition	16/11/22 00 PM
○	Cardiology	16/11/24 00 PM
○	Cardiology	16/11/24 00 PM
○	ENT	16/11/23 00 PM
○	Medicine	16/11/23 00 PM
○	Haematology	16/11/24 00 PM
	Cardiology	16/11/24

Fig 4.13: Appointment from Previous Record View

Empty options are going to be neglected by the site. Also there is a confirm check mark which needs to be check else the submit button will not work. All this is to ensure the correctness of patient decision.

Selecting a valid option user has to make request for appointment. The payment status of the user will be updated and will be waiting for the payment authentication code. If the user provides the transaction code than background process of cron job will verify the payment else after 15 from that moment if there is no input from user than the appointment will be cancel.
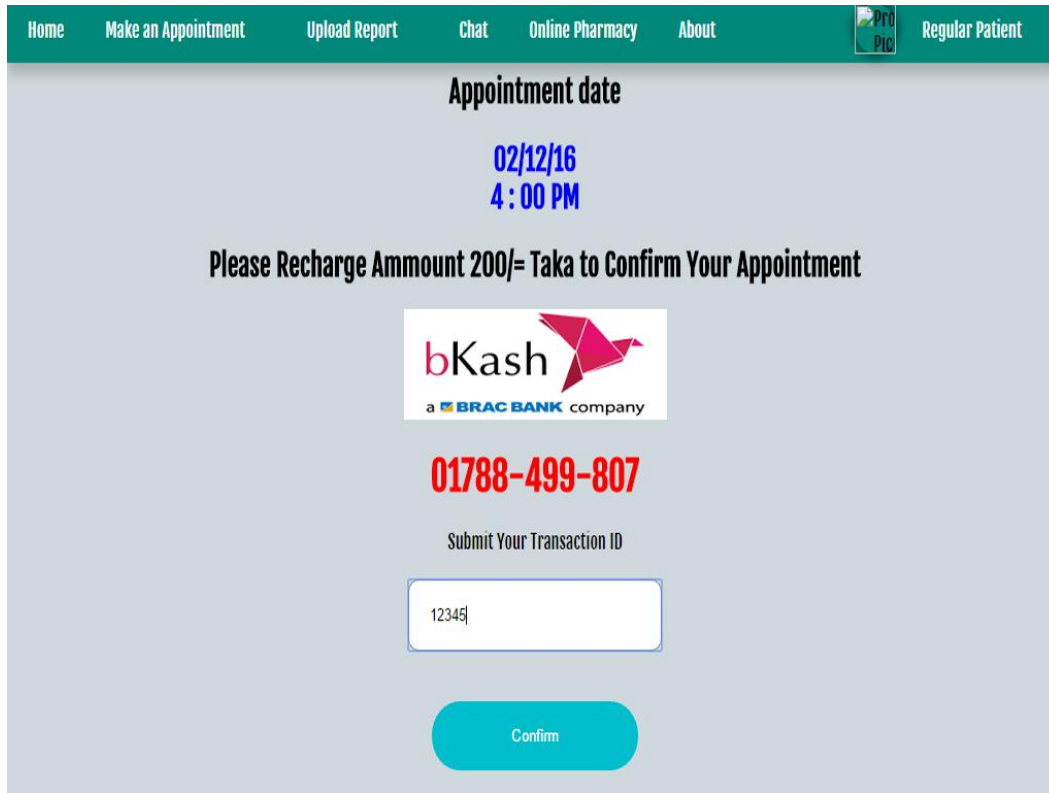
Fig 4.14 Payment View

After uploading the transaction id by user and the id being verified by system, patient will see the appointment date along with the transaction id he/she just had uploaded.

4.3 Hardware Implementation

4.3.1 Payment through bKash mobile banking

We implemented a system to make the payment system fully automated. Our website asks our users to pay the doctor fee through bKash, the popular mobile banking. We have make a unique system to trace all the transactions to the receiving end bKash account.

Whenever a bKash transaction is made, both ends gets a SMS regarding the transaction details. We made an electronic device and a computer program. Our device is an Arduino [23] based program which interfaces with a SIM900a mini [24] module to connect to the GSM network. We used Python for the computer side program. Together, that device continuously checks if any transaction is made to that account. We used to different Serial connections to communicate with both the SIM module and the

computer. If it receives any SMS from bKash server, it instantly updates the billing status on the database. Then the billing status on the user database can be easily updated if the transaction details matches with the user given input of transaction id.

4.3.1.1 Serial interface between Arduino and SIM900a

To make this device, firstly, we had to interface the SIM module with the Arduino development board. We used serial interfacing between these two components. To establish the serial communication we had to connect the components with two wires. One for TX and another for RX. This type of interfacing follows the UART protocol. To maintain signal voltage level between to components we had to short the grounds of both of them.

4.3.1.2 Serial communication between Computer and Arduino

To take the data sent from Arduino to the computer or the server, we used serial communication. Here, in this case, Arduino comes with built-in serial to USB converter. So, we could connect the device directly with the computer though a USB cable. Whenever a text message or SMS is received in the device, it sends it to the computer through the USB cable using the serial communication. The rest is then done on the computer or the server using a Python script
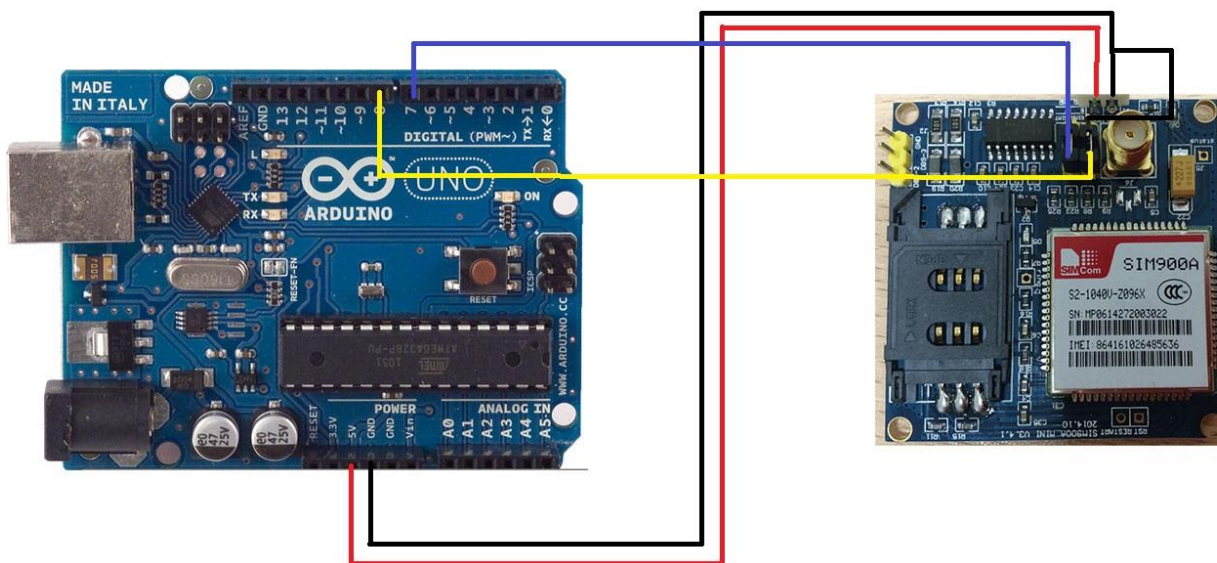

Figure no 4.15 – Arduino and SIM900a interfacing

4.3.2 Python Script

The python script that we made analyses all the data sent to the computer or server. First, it checks if the SMS send to the device is from the bKash server or not. If it is a legit bKash transaction SMS, it analyses the SMS and extracts the transaction information like reviving time, senders mobile number, received amount of money, transaction id etc. from the SMS. Then the script immediately saves the details by updating it in a database.

```python
 7   connection = sqlite3.connect('SMSdb.db')
 8   cursor = connection.cursor()
 9   arduinoData = serial.Serial('COM3', 9600)
10   while(1==1):
11       myData = (arduinoData.readline().strip())
12       savedText = myData.decode('utf-8')
13       print(savedText)
14       if "You" in savedText:
15           sql_inj="INSERT INTO SMS_table values ("+"12, '"+savedText+"')"
16           print (sql_inj)
17           cursor.execute(sql_inj)
18           connection.commit()
```

Figure no 4.16 – Python script

4.3.3 Database

We created a dedicated database only to store the details of the received SMS. The database stores the time of the transaction, the whole SMS, senders phone number, amount of money received, reference field on the payment, and the counter number given on that transaction. All the data is recorded for any troubleshooting or error fixing if the user makes any mistakes of the automated system fails to update any billing status properly. Recorded data can give the admins the opportunity to do any analysis regarding the payment if it is farther needed.

	Time	SMS	Sender	Amount	Reference	Counter	TrxID
1	2016-03-19	You have revi...	01681359643	1200.00	B	1	455756
2	2016-03-19	You have revi...	01681359643	1200.00	Bill. Counter 1	1	455756
3	2016-03-19	You have revi...	01681359643	1200.00	Bill	1	455756
4	2016-03-19	You have revi...	01681359643	1200.00	Bill	1	455756
5	2016-03-19	You have revi...	01783359643	2250.00	shuvodeep	1	592756
6	2016-03-19	You have revi...	01754800002	730.00	sayeed	1	215706
7	2016-04-03	You have revi...	01754812343	1030.00	Rony	1	215706
8	2016-04-03	You have revi...	01751386623	345.00	Utsash	1	221306
9	2016-04-04	You have revi...	01754800003	1330.00	Rony	1	215706
10	2016-04-06	You have revi...	01755807643	9530.00	Prince	2	917216

Table no 4.2 – Populated transaction table

Chapter 5

Result and Analysis

5.1 Welcome Screen

The first view when a user access the website is mainly a big promotion banner and a prompt message to login or register to access the service. The website has a top navigation panel which has a home button, and login or register button, a link to the built-in online pharmacy and a About button to view some information about the service owners.
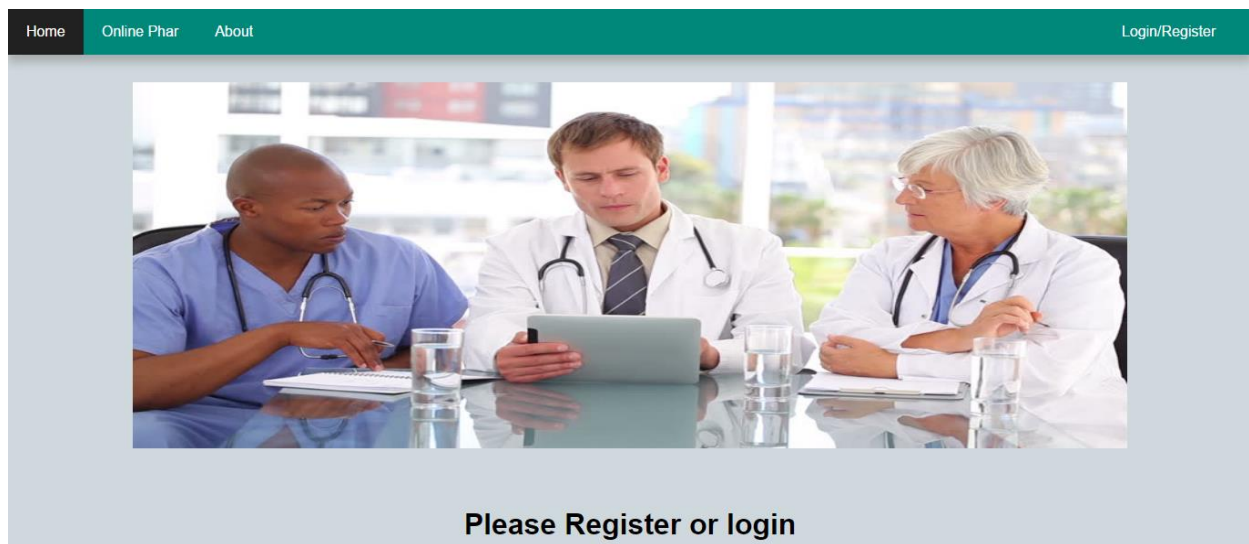

Figure 5.1 – Welcome Screen

5.2 User Information Database

The registration process of a service populates a database that holds all the information about the user. It stores the user id of the user which is an automatically created number that is unique for every member. It holds the personal information of a user, the payment status and the encrypted password.

161104104622	0	0	Dr.	Strange		-1	dr.strange.gmail.com	$2y$10$rfRzX0BLQOW8G0FPwlbCT./u16u/WHoz.83Jr0LL98X...
161106074110	0	0	Sayeed	Hasan		-1	sayeedhasan@gmail.c	$2y$10$X7.uwcRYE5zR9GNsehBOY.GWVLLwiV04iFcNVv133ji...
161108023130	0	0	Sajid	Hasan	0155231897	-1	sajid@gmail.com	$2y$10$2rA2T4I03I9QZtCDzpZufedZ2MR3nJ3I05Cw3auJIDr...
161114095443	0	0	Regular	Patient	0123456789(	-1	patient@test.com	$2y$10$E6A0nwggelWMk.zqctKNNOAPtLG9hjn4u27ISimYbsY...
161115104715	8	101112131819	Doctor	Test	0123456789(	-1	doctor@test.com	$2y$10$mtRGas32snS2NsRfQAbSK.iz5EfhYgU5H3tZyIGFBQT...
161211075107	0	0	Ashraf	Sirajee	0167342157	-1	ashraf.sirajee@gmail.c	$2y$10$/sa1mclibRZCt1WkPF3PyufMXR.bErWaZlcrAJsfZeU...

Figure 5.2 – User information database

5.3 Registration Page

Users can register by providing their First name, Last name, Phone number, and desired password. The page checks if the required fields are properly filled or not and the two fields of the passwords matches or not.

Figure 5.3 – Registration page

5.4 Encrypted Password

Up on clicking the registration button after properly filling the fields, everything is saved directly to the database, except for the password. It is first encrypted then the encrypted data is saved to the database. This is done to increase the security of the account. The encrypted password can be seen from the database screenshot and it is easily recognizable by the common pattern starting with a dollar sign ($).

161104104622	0	0	Dr.	Strange		-1	dr.strange.gmail.com	$2y$10$rfRzX0BLQOW8G0FPwIbCT./u16u/WHoz.83Jr0LL98X...
161106074110	0	0	Sayeed	Hasan		-1	sayeedhasan@gmail.com	$2y$10$X7.uwcRYE5zR9GNsehBOY.GWVLLwiV04iFcNVv133ji...
161108023130	0	0	Sajid	Hasan	01552318974	-1	sajid@gmail.com	$2y$10$2rA2T4I03I9QZtCDzpZufedZ2MR3nJ3I05Cw3auJIDr...
161114095443	0	0	Regular	Patient	01234567890	-1	patient@test.com	$2y$10$E6A0nwggeIWMk.zqctKNNOAPtLG9hjn4u27ISimYbsY...
161115104715	8	1011121318192	Doctor	Test	01234567890	-1	doctor@test.com	$2y$10$mtRGas32snS2NsRfQAbSK.iz5EfhYgU5H3tZyIGFBQT...
161211075107	0	0	Ashraf	Sirajee	01673421571	-1	ashraf.sirajee@gmail.com	$2y$10$/sa1mclibRZCt1WkPF3PyufMXR.bErWaZIcrAJsfZeU...
161212023715	0	0	Shuvodeep	Biswas	01683303443	-1	shuvodeep.20j@gmail.con	$2y$10$un2A5vHFOa2Ecir3umLhT..E6H5envGjtAHjw3139aZ...

Figure 5.4 – Encrypted password in database

6.5 Login

After a successful registration process a user can login with their user or email id and password for rest of the time.

Figure 5.5 – Login screen

5.6 Dashboard

After a user has logged in properly, he or she will be exposed to the services. User will now be able to go another page to make an appointment if it is the first time. The user can also go the chat room from here or the report uploading page or the online pharmacy from here.
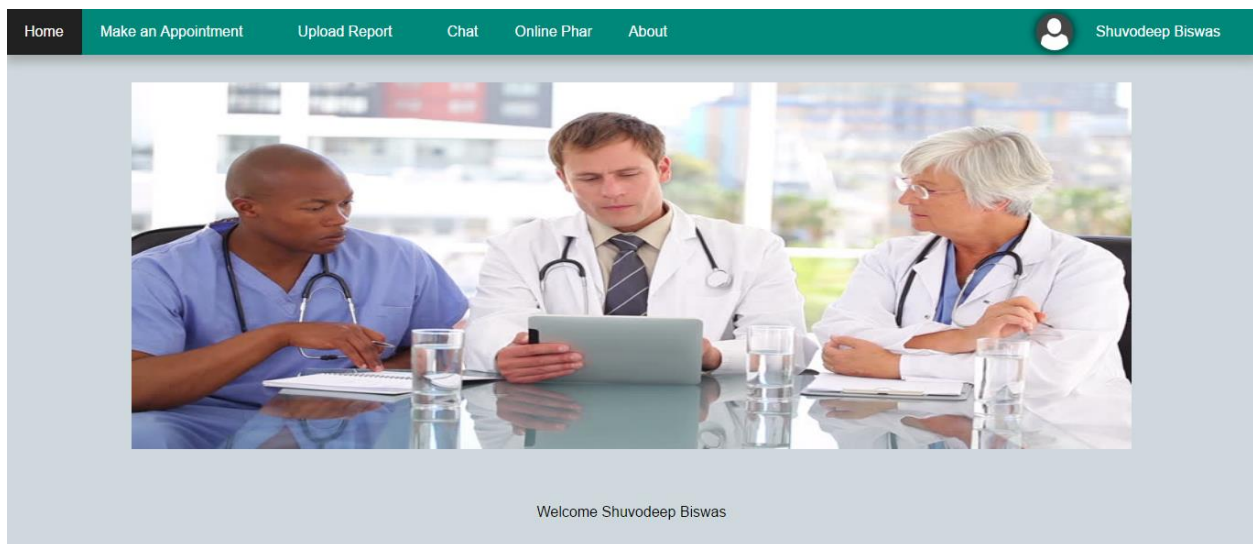

Figure 5.6 - Dashboard

5.7 User Profile

After registering and logging in, a user can add or change a profile picture or change other details if he or she wishes.

Figure 5.7 – Profile

5.8 Making an Appointment

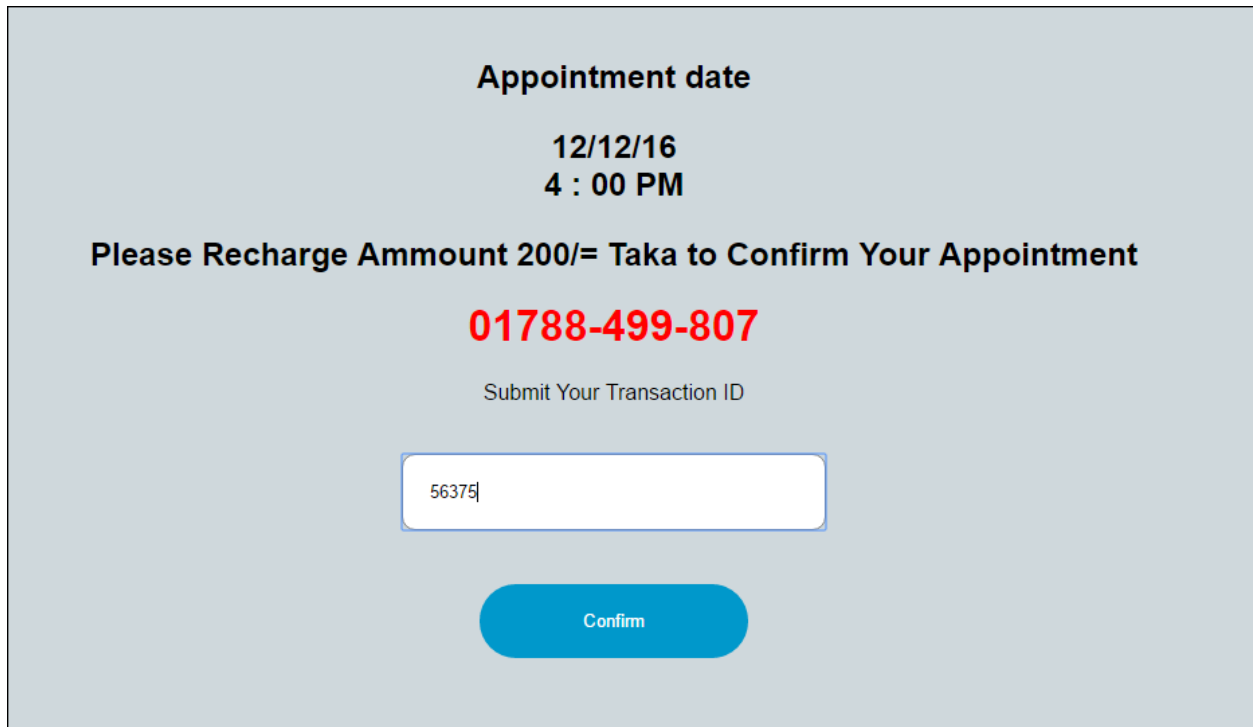User can make an appointment by providing the desired date and the desired department of doctors.

Figure 5.8 – Appointment making

5.9 Payment screen

User have to enter the transaction id no of the bKash payment. The transaction id will be matched with the recorded payment history and if matched the payment status will be updated.

Fig no 5.9 - Payment Screen

5.10 Report Uploading

In the report uploading page, user can manually input the values of the medical reports which will be directly visible to the doctor for any analysis. There will be the standard healthy value shown beside it for easier comparison.

Hematology Report From

Please donot fill up unknown fields

Test	Result		Reference Value
Hamoglobin	12	g/dL	F (11.5-15.5), M (12-12) g/dL
ESR(Westergren Method)	35	mm/hr	Men <50 Y:<15>50 Y:<20; Woman <50 Y:<20>50 Y:<30
Total Count			
RED Blood Cells	5.1	X10e6/uL	F(3.8-4.8) M(4.5-5.5) X 10e6/uL
Plateles	335	X10e3/uL	150-450 X10e3/uL
WHITE Blood Cells	10.2	X10e3/uL	Adult 4.0-11.0; Child(Birth-1mon):6.0-36.0 Child(6mon-3yrs):6.0-17.5; Child(4-10years):5.5-14.5
Differential Count			
Neutophil	35	%	40 - 75%
Lymphocyte	36	%	20 - 50%
Monocyte	9	%	02 - 10%

Figure 5.10 – Report uploading

5.11 Saved medical reports

The medical reports that the user put is saved on the server side. Here is a sample medical report view.


```
Hamoglobin : 12 ref:[ F (11.5-15.5), M (12-12) g/dL ]
ESR : 35 ref:[ Men <50 Y:<15>50 Y:<20; Woman <50 Y:<20>50 Y:<30 ]
RED Blood Cells : 5.1 ref:[ F(3.8-4.8) M(4.5-5.5) X 10e6/uL ]
Plateles : 335 ref:[ 150-450 X10e3/uL ]
WHITE Blood Cells : 10.2 ref:[ Adult 4.0-11.0;<br>Child(Birth-1mon):6.0-36.0<br>
                    Child(6mon-3yrs):6.0-17.5;<br>Child(4-10years):5.5-14.5 ]
Neutophil : 35 ref:[ 40%-75% ]
Lymphocyte : 36 ref:[ 20%-50% ]
Monocyte : 9 ref:[ 02%-10% ]
Eosinophil : 3 ref:[ 1%-6% ]
Basophil : 0.8 ref:[ < 1%]
P.C.V (Hct) : 49 ref:[ F: 37-47%, M: 40-52% ]
M.C.V. : 82 ref:[ 82-10fL ]
M.C.H. : 30.9 ref:[ 27-32 pg ]
M.C.H.C. : 32 ref:[ 30 - 35 g/dL ]
R.D.W.-C.V. : 12 ref:[ 11.60 - 14.00 % ]
R.D.W.-S.D. : 41 ref:[ 39.00 - 46.00 fL ]
```

Figure 5.11 – Saved medical report

Chapter 6

Conclusion and Future Work

Conclusion

We started the project keeping in mind to solve one of the very old issues of the whole world which is availability of medical support. It is not possible to change the medical support system over night. Our goal was to provide a solution so that this problem could be minimized and provides medical support to every corner even the remotest area where people are unable to reach a doctor when needed. In order to eliminate the difficulties of scheduling we came up with dynamic scheduling system which will also eradicate the waiting for a doctor physically in front of the chamber. We achieved our goal which is this system can balance the load among doctors and schedule a patient to a specified specialist and at the scheduled time the patient can communicate with the assigned doctor. We believed our motive to develop this project can reduce the unnecessary hassles of traveling all the way to the doctor and save their valuable time. Which can eventually prevent the patient from suffering further?

Future Work

We have future improvement plan regarding this project. As it is an online based system, we intend to make this system a global platform where users from all over the world will be able to consult a specialist of their interest. We also have the plan of developing mobile application to access this system in order make it more easy to use. We also have the plan for free checkup campaign by the available doctors once a month. The hardware system uses SQLite database where software uses MySQL database, we have to adjust quite a bit to keep up the track. In near future drawbacks could be overcome. If a doctor needs to make changes to his or her schedule they need to wait 10 days because of the architecture of our system. We would like too improve that side of our project.

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