PATIENT RELATIONSHIP MANAGEMENT SYSTEM IN CONTEXT OF TELEMEDICINE IN BANGLADESH

BY

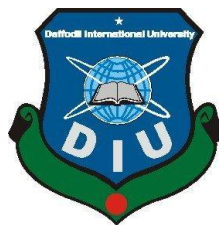**MUHAMMAD ABDULLAH**
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This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Computer Science and Engineering.

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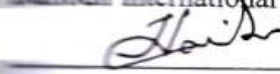**DHAKA, BANGLADESH**
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APPROVAL

This Project titled **"Patient Relationship Management System in Context of Telemedicine in Bangladesh"**, submitted by Muhammad Abdullah and MD. Akbar Hossain to the Department of Computer Science and Engineering, Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on 22 August 2015.
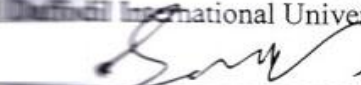
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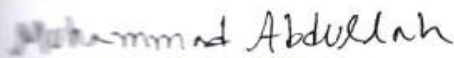Jahangirnagar University

DECLARATION

We hereby declare that, this project has been done by us under the supervision of **Dr. Syed Akhter Hossain, Professor & Head, Department of CSE** Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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Finally, we must acknowledge with due respect the constant support and patients of our parents.

ABSTRACT

Information Technology spread day by day. In this present era people depend on information technology. In this era of digitization it is necessary to create such a system, that system seems to be a tool to create and maintain better communication with the patients rather than just a technological solution. We can use Present Technology for solving many problems; Patient Relationship Management System is one of the ways to provide service that people who is needed this service. In this system we provide all service to a patient through online. From this system a rural patient can get service from a well-known doctor. That is so too easy as a rural people. Patient can create profile for doctor's appointment and an assistant doctor confirms the appointment. For individual physicians it provides a way to reflect professional skills. The system was lacking in its support for one-to-one communication with patients. Nevertheless, the system is an example of patient relationship management which may help healthcare units to move towards a more patient-oriented care.

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CHAPTER ONE

Introduction

1.1 Objectives

1.1.1 General Objective

A patient relationship management system (PRMS) application allows hospitals a better understanding of patients' needs and wants through improved communication via follow-up systems.

1.1.2 Specific Objectives

The project's specific objectives were;

    i.   To study and understand patient interaction with doctor in general hospital.

   ii.   To develop the concept of patient relationship management system from the prospective in Bangladesh.

  iii.   To implement the proposed model of telemedicine using open source technology.

  iv.   To deploy the develop system for practical use in hospital patient relationship management.

1.2 Motivation

Patient relationship management System (PRMS) brings the concepts of customer relationship management (CRM) to healthcare. In the business world, customer relationship management is used to retain customer loyalty in order to increase revenue.

This customer-centric strategy and the software that underpins it help organizations to improve customer satisfaction, to reduce costs, to serve their customers better and to improve the overall efficiency of their customer centric processes. Healthcare organizations can build the same kind of relationship with patients, and it can also offer more tangible benefits.

Telemedicine is one of the major parts of the medical Science in the world. But it is difficult to communicate with a doctor from home. We were inspired on the critical situation of the patients. That's why we develop this system. Here a patient can take necessary information from this website. Though here are some limitations also. So we create our own PRMS (Patient relationship management System) where everyone will get service and also a prescription will be generated.

1.3 Expected Outcome

The main objective of telemedicine is to cross the geographical berries and provide healthcare facilities to rural and remote areas (health for all) so it is beneficial for the population living in isolated communities. Besides this other advantages of telemedicine are they will be able to do all this, like:

- ❖ Improving patient care.
- ❖ Improve access to health care for rural areas and underserved areas.
- ❖ Reduce or eliminate the time and expense of travel necessary to bring the patient to doctor or vice versa.
- ❖ Give physician better access to tertiary consultation.
- ❖ Give physician access to conduct remote examinations.
- ❖ Reduce health-care costs.
- ❖ Provide health care services of a physician or facility to larger audience (larger geographic regions and populations).
- ❖ Reduce patient transfers to secondary and tertiary care centers.
- ❖ Online Doctor Appointment System
- ❖ Audio or Video Call
- ❖ Get suggestion or Prescription

- ❖ Store Patient History
- ❖ Patient Profile System

1.4 Layout of the Report

Chapter 1: In chapter one, I discuss about the introduction. Discuss about the objective, motivation, expected outcome and others in details.

Chapter 2: In chapter two, discuss about the requirements of proposed system, high level requirements, use case model and description, logical data model Also discuss the roles and responsibilities on patient relationship management system.

Chapter 3: In this chapter, discussing about the implementation and testing, process implementation, GUI and interactions and also propose testing implementation.

Chapter 4: In this chapter, I discuss about the result of conclusion and the future scope of that PRMS Application.

CHAPTER TWO

Requirements of Proposed System

2.1 High Level Requirements

2.1.1 Telemedicine Technology Components

- ❖ Telemedicine workstation.
- ❖ Telemedicine peripherals.
- ❖ Telecommunication network architecture.
- ❖ Software architecture.
- ❖ Human intervention.

2.1.2 Methods

- ❖ Store and forward.
- ❖ Teleconferencing.
- ❖ Videoconferencing.

Store and forward method, where a patient file including patient's medical history, diagnostic images, medical scans (X-ray, CT, USG etc.), diagnostics reports and clinical findings along with other relevant demographic information are stored using any suitable telemedicine software. This file is a multimedia record called Electronic Medical Record (EMR) is then transmitted to a medical expert or better medical facility for diagnosis and treatment advices. Store and forward overcomes the barrier of coordinating different physicians schedule for consultation. Any consultant can go the patient file and view detail of the condition to provide his or her expert opinion at his or her convenience. This is not effective in case where emergency medical intervention is required.

Teleconferencing was always a part of Tele-consultation between colleagues for appropriate management of patients from early days of the last century after invention of the telephone system. Still doctors are very used to this mode of Tele-consultation among themselves.

Videoconferencing is the most appropriate mechanism to have Tele-consultation but it needs expensive set of equipment and along with high bandwidth requirement, which is the most expensive item to buy in Bangladesh. Although, being citizens of the poorest country we are paying the highest cost for telecommunication channels (bandwidth) in the world, sometime even higher than the USA, UK and India for sure. When we will be able get outside communication using links like ISDN, ATM, frame relay from fiber-optic cable lines then videoconferencing will be an integral part of our telemedicine system. Till then let us stay our finger-crossed for development of such infrastructure in near future.

2.2 Use Case Model and Description

The Use Case Model describes the proposed functionality of the new system. A Use Case represents a discrete unit of interaction between a user (human or machine) and the system. A Use Case is a single unit of meaningful work; for example login to system, register with system and create order are all Use Cases. Each Use Case has a description which describes the functionality that will be built in the proposed system. A Use Case may 'include' another Use Case's functionality or 'extend' another Use Case with its own behavior [17].

Use Cases are typically related to 'actors'. An actor is a human or machine entity that interacts with the system to perform meaningful work. In our Project there are two actors. They are

❖ Admin
❖ Doctor
❖ Assistant Doctor
❖ Patient

2.2.1 USE Case Description: (for Patient)

USE Case Title: Registration

Actor: Patient

Primary Path:

1. Click the link "Sign up Here"

2. Enter necessary information

3. Click the button "Sign up"

4. Appointment Doctor ⟶Choose Department ⟶ Choose Doctor⟶Choose Date⟶Choose Time Slot.
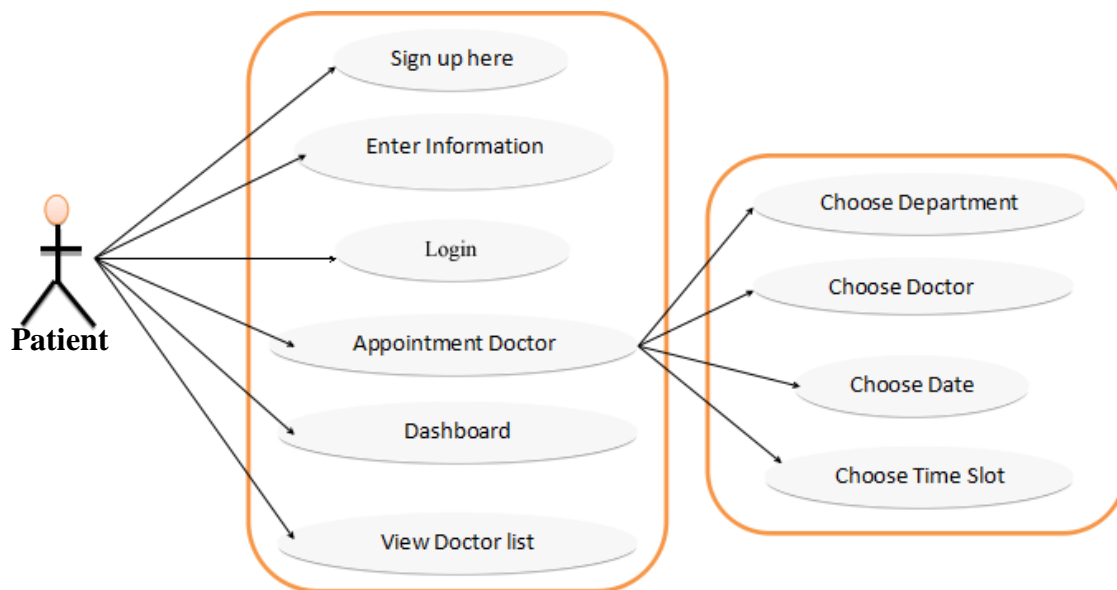
5. View Dashboard.
6. View All Doctor List

Figure 1: Use Case Model for patient

2.2.2 USE Case Description: (for Assistant Doctor)

USE Case Title: Registration and other process

Actor: Patient

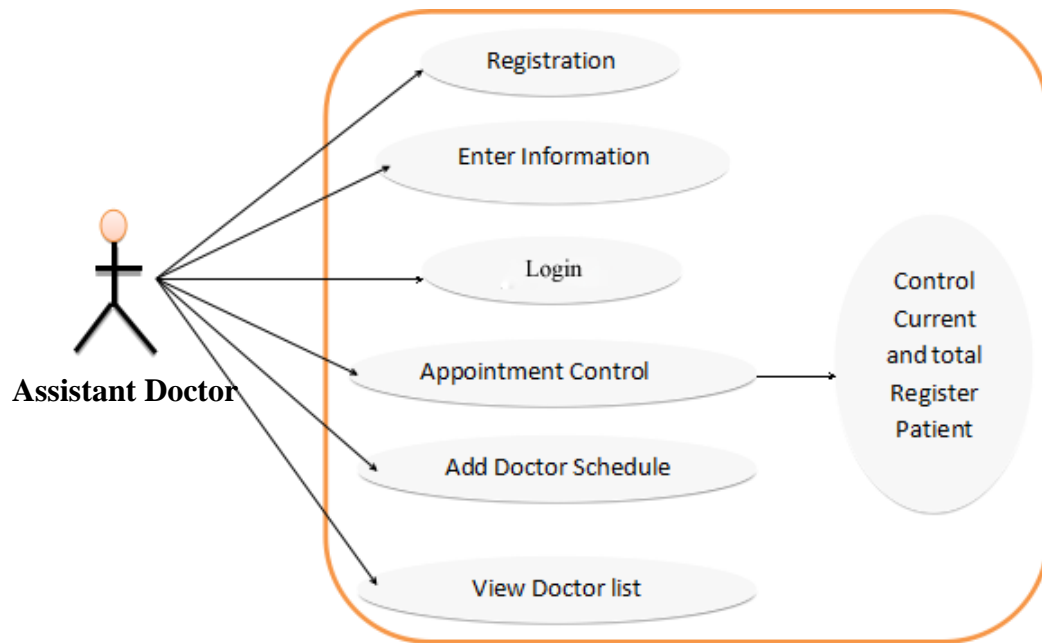Primary Path:

Assistant Doctor

Figure 2: Use Case Model for Assistant Doctor

2.2.3 USE Case Description: (for Doctor)

USE Case Title: Registration and other process
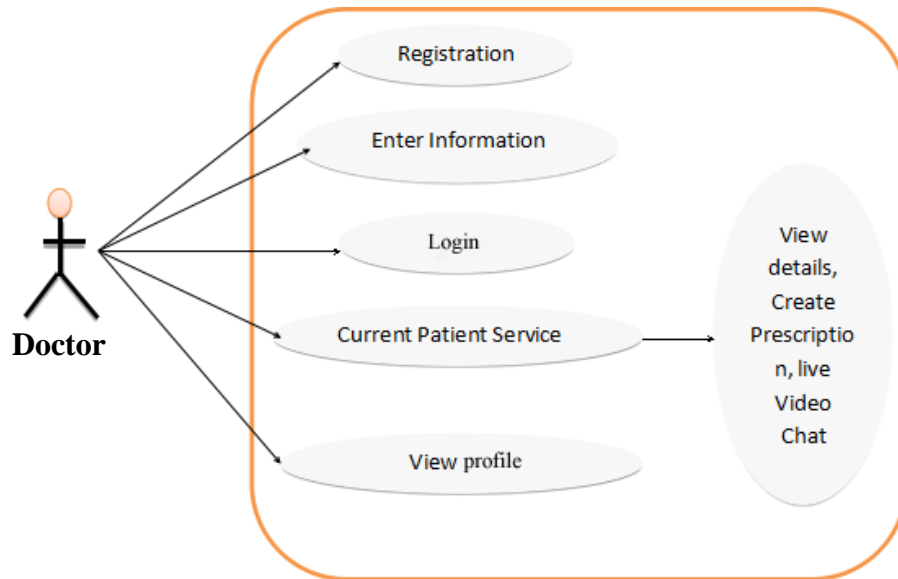
Actor: Doctor

Primary Path:

Figure 3: Use Case Model for Doctor

2.2.4 USE Case Description: (for Admin)

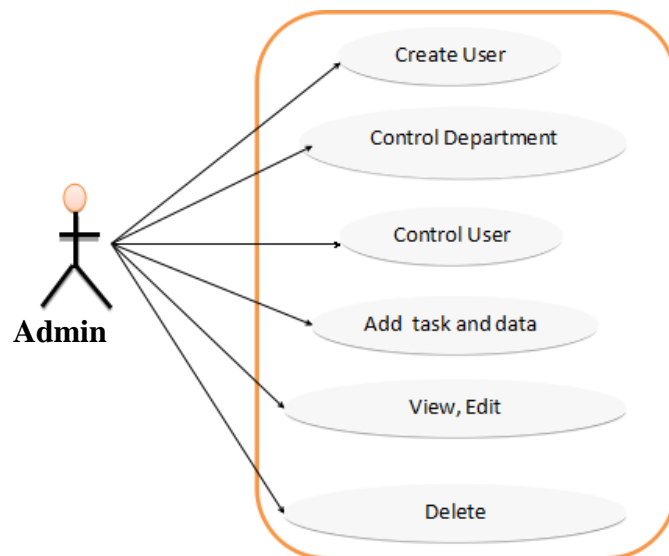USE Case Title: Control

Actor: Admin

Primary Path:

Figure 4: Use Case Model for Admin

2.3 Process Models

2.3.1 System Analysis

The system analysis is a detailed study of the various operations performed by the existing system and their relationships within and outside of the system. One aspect of analysis is defining the boundaries of the system and determining whether a candidate system should consider other related systems. Here we completed system analysis by the input analysis and output analysis of existing system. At the preliminary stage of the analysis, we had followed the Waterfall Development Methodology.

2.3.2 Waterfall Model

The waterfall model is a sequential software development process, in which progress is seen as flowing steadily downwards through the phases of Conception, Initiation, Analysis, Design, Construction, Testing and Maintenance [6].
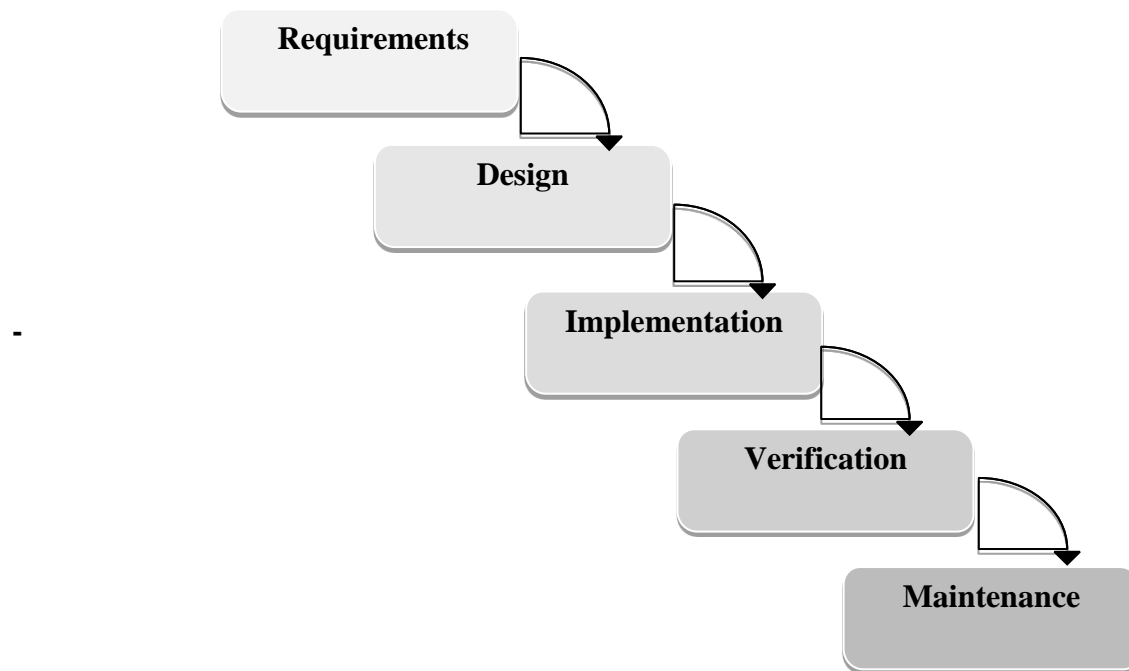
The following figure 5 shows Water Fall Model.

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Figure5: Water Fall Model

2.3.2.1 Requirements

All possible requirements of the system to be developed are captured in this phase. Requirements are a set of functions and constraints that the end user (who will be using the system) expects from the system. The requirements are gathered from the end user at the start of the software development phase. These requirements are analyzed for their validity, and the possibility of incorporating the requirements in the system to be developed is also studied. Finally, a requirement specification document is created which serves the purpose of guideline for the next phase of the model.

2.3.2.2 Design

The software developers design a technical solution to the problems set out by the product requirements, including scenarios, layouts and data models. This phase is usually accompanied by documentation for each requirement, which enables other members of the team to review it for validation.

2.3.2.3 Implementation

In computer science, an implementation is a realization of a technical specification or algorithm as a program, software component, or other computer system through programming and deployment. Many implementations may exist for a given specification or standard. For example, web browsers contain implementations of World Wide Web Consortium-recommended specifications, and software development tools contain implementations of programming languages.

2.3.2.4 Testing

Upon completion of full implementation, testing needs to occur before the product can be released to customers. The software testing team will use the design documents, personas and user case scenarios delivered by the product manager in order to create their test cases. Several testing types are available:

- Black Box Testing
- White Box Testing
- Alpha Testing

- Beta Testing
- Software Application Testing

2.3.2.5 Maintenance

Maintenance is the modification of a software product after delivery to correct faults, to improve performance or other attributes. We will be responsible to solve for all kinds of software faults after delivery.

2.4 Logical Data Model

A Logical data model is the version of a data model that represents the business requirements (entire or part) of an organization and it is developed before the physical data model. This is the actual implementation and extension of a conceptual data model. A sound logical design should streamline the physical design process by clearly defining data structures and the relationships between them. Logical data model includes all required entities, attributes, key groups, and relationships that represent business information and define business rules.

2.5 Implementation Requirements

2.5.1 Suggested technical requirements for telemedicine in Bangladesh

From a technology standpoint, telemedicine is the application of telecommunication and computer technologies that already in use in other industries. The technology infrastructure is a telecommunications network with input and output devices at each connected location.

We propose two types of telemedicine backbone in Bangladesh

(i) Expensive / dedicated 4G technology,

(ii) Cost- effective / Internet-based telemedicine link (IBTL).

By 4G technology includes voice telephone, video calls, and wireless data, all in a mobile environment allows simultaneous use but required high bandwidth (potential estimated at a range up to 100-300Mbps on the downlink and 500Mbps on the uplink). In second case considering available telecommunication infrastructure in Bangladesh we propose cost effective Internet based telemedicine (IBT) system to promote the idea of E-medicine.

2.5.2 Successful Telemedicine Project in Bangladesh are established in

1. BIRDEM hospital.

2. Medinova medical services.

3. Popular diagnostic center

2.6 Roles and Responsibilities

2.6.1 Challenges and risks of telemedicine in Bangladesh

Awareness

❖ In the traditional health service system the physician physically examines the patient which gives sometimes a mental satisfaction to the patient, but in the telemedicine service this is not possible.

❖ General people are not aware of the system how the system will work.

❖ Inexistence of government initiative and policy.

2.6.2 Patient's problem

❖ The confidential information about the female patient may be known to others.

❖ Patient might not be comfortable in telemedicine service through the video conference.

❖ Ignorance or illiteracy might create some problem.

❖ Reliability issues of the patients.

2.6.3 Doctor's problem

❖ Since direct consultation with the specialist is not possible through this system, hence only observation may be a challenge for proper diagnosis and treatment.

❖ Local doctors and village doctors may resist the PRMS system due to the fears about their professionalism.

❖ In case of accident, how the PRMS would work is not clear, hence doctors/specialists should be available on-call all the time or round the clock services should be ensured.

2.6.4 Technical problem

- ❖ Ensuring health service system to the people, load shedding of electricity and reliability of the service might be challenges.
- ❖ Internet facilities are not available in every place.
- ❖ Computer illiteracy, reluctance and phobia.
- ❖ Cost effectiveness of the service might also be a problem.
- ❖ Unavailability of data transfer connectivity.
- ❖ Scarcity of TM-supported imaging equipment's.

There is risk if proper maintenance or management services are not available.

Community acceptance is an essential pre-requisite and can be ensured through strategically designed campaigns and appropriate media publicity. Overall, the comments were that if the proper services by the TMS continue and people feel about its advantages, and then there will be no risk.

2.6.5 Financial problem

- ❖ High cost of bandwidth and telemedicine equipment's.
- ❖ In the village the poor patient cannot manage the high consultation fee of doctor.

CHAPTER THREE

Implementation and Testing

3.1 Physical Schema

3.1.1 Proposed Architecture

The structure of our proposed architecture shown in Figure 6 is created by integrating a WMSN with a 4G cellular network. The WMSN provides a platform for acquiring medical data from the patients and sends it through a 4G based wireless cellular network to the specialist for analysis and diagnosis. The architecture is made up of cameras, speakers, interactive television, different biomedical sensors (handheld and wearable devices), local storage server and a gateway. Biomedical sensors include digital stethoscope for measuring the heartbeat, ophthalmoscope and others. It provides real-time consultation and continuous monitoring of the patients physiological data regardless of location provided the location has a 4G wireless network coverage needed for the multimedia streaming for transmitting the required data to the specialist at a distant location. The 4G cellular network provides the long range telemedicine facilities between the specialist and patient's healthcare center, thus providing global services displaying figure 6.
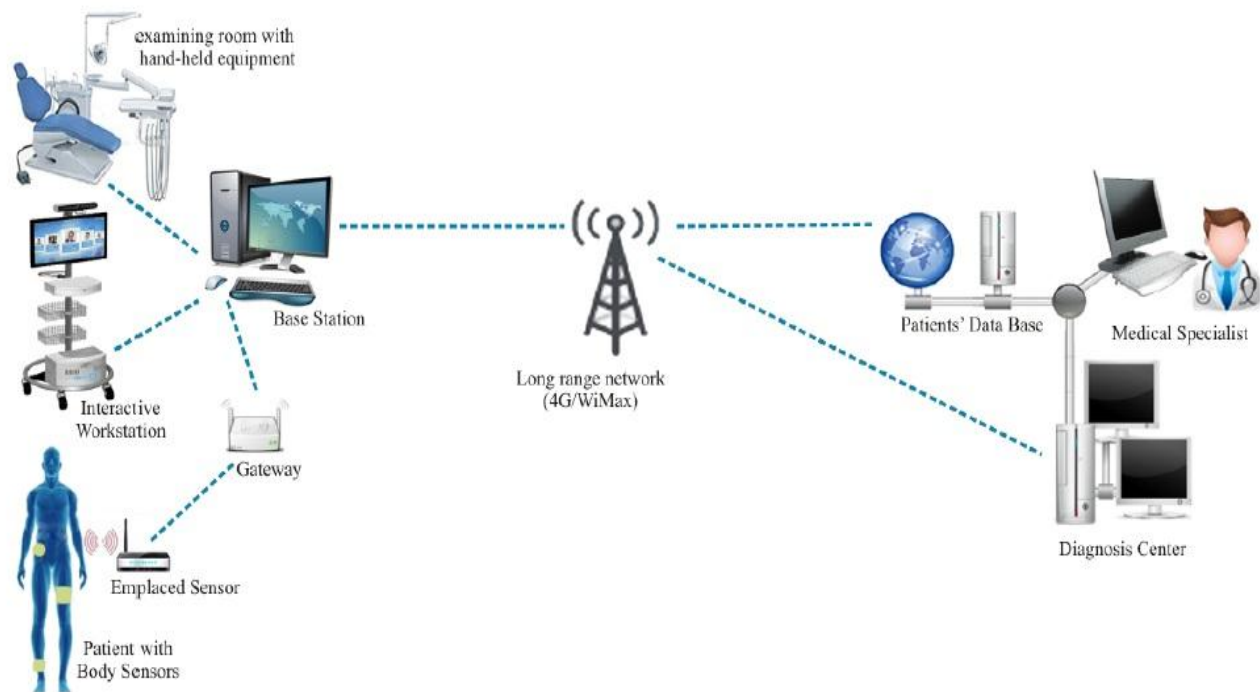
Figure 6: PRMS Proposed Architecture

3.1.2 How it Works

The proposed architecture supports heterogeneous networking. Using Ultra-Wideband (UWB) network, it forms an island of sensors Wireless Multimedia Sensor Network (WMSN), and these different sensors collect the required data from the patient depending on the telemedicine type (i.e. live, store and forward, monitoring telemedicine). The medical data is processed (compressed, encrypted, etc.) and then it is sent to the gateway (the only IP addressable component of the WMSN) and it's also stored locally in the storage server. The gateway provides the connectivity and integration with the WiMAX network. The WiMAX network transmits the data over a long communication range to the specialist in another area. The data is received at the specialist side, the data is checked if it's valid and then after it can be processed (decrypted, decompressed), Then the data can be analyzed and then used for diagnosis and treatment [11].

3.1.3 Using Customer Relationship Management (CRM) to Manage Patient Relationships.

Figure 7: Using CRM to Manage Patient Relationships.

The illustration above shows how a CRM application can be customized to enable patient relationship management within health organizations. Taking a patient relationship management system, healthcare providers can move beyond treating episodes of illness to enabling proactive care by establishing productive, long-term relationships with patients. Patient relationship management systems can:

3.1.4 Increase patient satisfaction

By analyzing the performance of routine processes over, improvements can be made to eliminate unnecessary steps and increase patient satisfaction.

3.1.5 Coordinate the delivery of care

Customized workflows can be developed to automate care coordination activities between provider organizations, which can help improve patient outcomes while increasing operational efficiency and reducing costs.

3.1.6 Proactively manage chronically ill patients

Clinicians can flag patients with specific chronic illnesses and automate targeted, proactive communications to inform them of upcoming educational offerings and remind them of ways to manage their illnesses.

3.1.7 Improve community relations

Targeted outreach campaigns can easily be developed and sent to community members to promote new services and educational offerings or to donors to update them on fund usage or fund-raising campaign progress. Relationship management tasks and communications with community members and financial donors can be automated to increase efficiency and improve results.

With healthcare costs on the rise, managers continually strive to streamline processes and make the best use of resources. With patient relationship management applications, health industry leaders can:

▪ Analyze process improvements and their impact on patient satisfaction

Facilitate increased patient-clinician interaction without adding additional administrative burden

▪ Increase community outreach focused on education, illness prevention, and overall health

▪ Integrate and extend existing IT investments using a patient relationship management system to build automated workflows that bridge gaps and streamline processes across systems.

3.2 Process Implementation

3.2.1 Registration

Every User must need registration for getting services. The registration is occurs in a process. First, any one complete the registration form .In registration form there are real time checking for username and email address where the username and email address are available or not. The password field has the strength bar where the bar shows the user password is strong or weak.

3.2.2 Login

In this system here user must have to login to get services. Here patient and doctor both is user. For getting feedback login is a must.

3.2.3 Profile

The profile system is generally user profile information. Where user will add their personal information. Like as full name, gender, blood group, present address and email address.

3.2.4 Message

In Message System user patient can send message to doctor .And the doctor also send feedback to the patient. User can see their previous send and received message. User can delete their send and received message.

3.2.5 Profile Picture

User both doctor and patient can upload their Profile picture. The picture support jpg, gif, png format. The maximum upload picture size is 3MB.

3.2.6 Change Password

User can change their password. Where user gives their current password and gets their new password. A notification email will be sent to the user email address that their password changed successfully. Admin also have the save change password facility.

3.2.7 Patient Category

Patient creates her profile system, patient chose department, doctor and date for appointment. Patient also must have to login to get services.

3.2.8 Assistant Doctor Category

Assistant doctor send the SMS or email confirm the patient appointment schedule.

3.2.9 Doctor Category

In Category Section Admin can add the category name like patient or doctor. Admin Can Manage the category such as add, delete, update. Patient can chose doctor from category system.

3.2.10 Admin Login

In admin Login page only one admin can login.

3.2.11 Admin Post Review

In admin Post Review page admin can see that, which user is done unnecessary request or who is disturbing patient. He can block the user.

3.2.12 Social Network

User can Share their problems with doctor. So this is also partially a social network System

3.2.13 Feedback

In our application patient write his or her problems to doctor. And doctor will give necessary suggestion or prescription.

3.3 GUI and Interactions

Designing the visual composition and of software application programming in the area of human goal is to enhance the efficiency and ease of use for the underlying logical design of a stored program, a design discipline design are used to ensure that the visual language introduced in the design is well tailored to the tasks.

The user interacts with information by manipulating visual widgets that allow for interactions appropriate to the kind of data they hold. The widgets of a well interface are selected to support the actions necessary to achieve the goals of the use. A model-view-controller allows for a flexible structure in which the interface is independent from and indirectly linked to application functionality, so the GUI can be easily customized. This allows the user to select or design a different skin at will and eases the designer's work to change the interface as the user needs evolve. Good user interface design relates to the user, not the system architecture.

A software interface designed to standardize and simplify the use of computer programs, as by using a mouse to manipulate text and images on a display screen featuring icons, windows, and menus.

An interface between a user and a computer system that involves the use of a mouse-controlled screen cursor to select options from menus, make choices with buttons, start programs by clicking icons, GUI [12].

Patient Relationship Management System (PRMS): Graphical User Interface
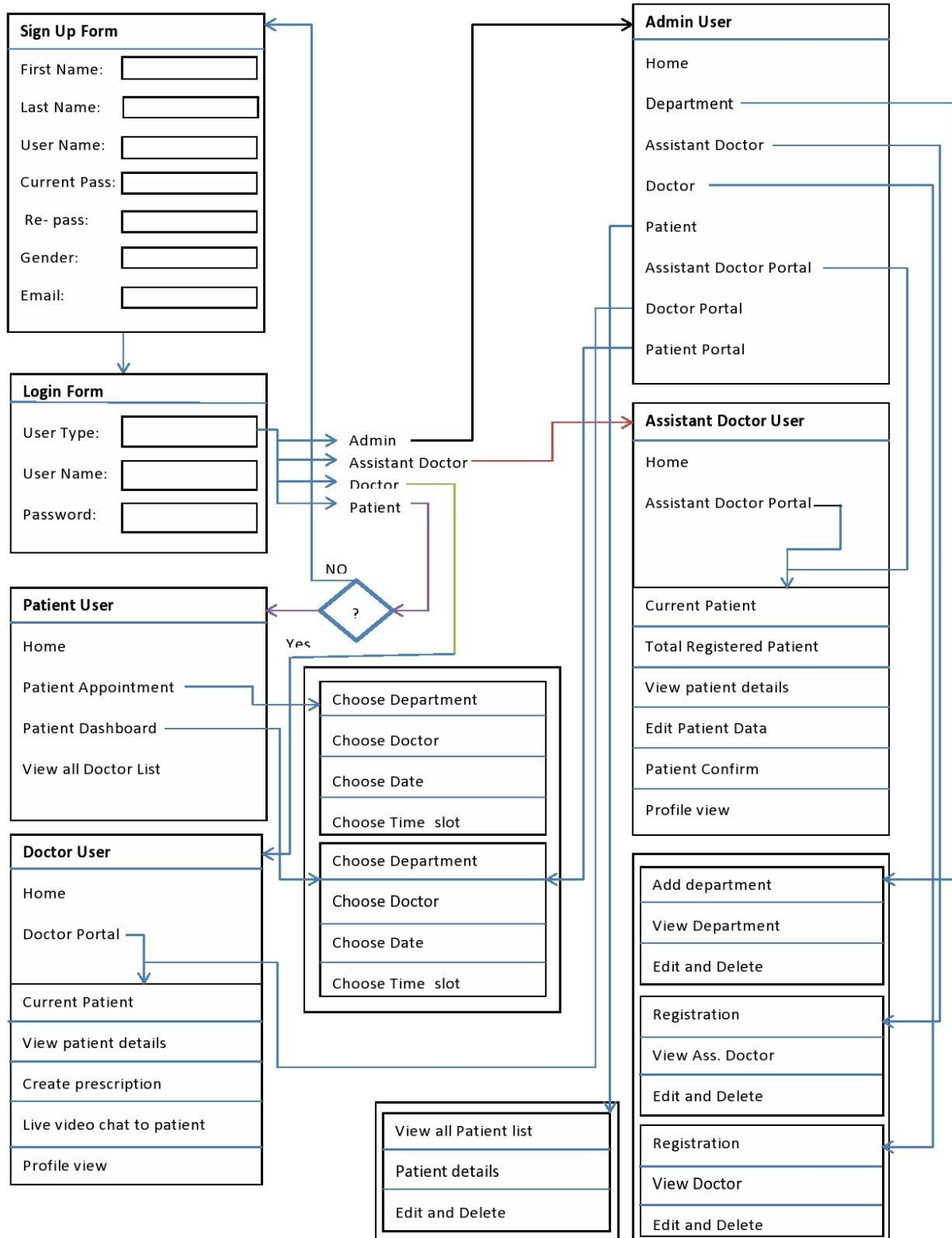
Figure 8: Graphical User Interface

3.3.1 PRMS Login Page Interaction

Patient Relationship Management System Login Page is displayed if Figure 9 which interacts with Users, User Security and User Type tables of PRMS database.

Figure 9: PRMS User Login

3.3.2 PRMS Home Page

This is Patient Relationship Management System (PRMS) home page. In this page user can access by as a doctor or as a patient. If user is a patient the he or she must have to register first time. If user is a doctor he or she also must have to register first time. Without registration no user can get services from this website. This process is not so difficult. But the user must have to fill up the register form. By successfully completing registration process user can get services displaying figure 10.
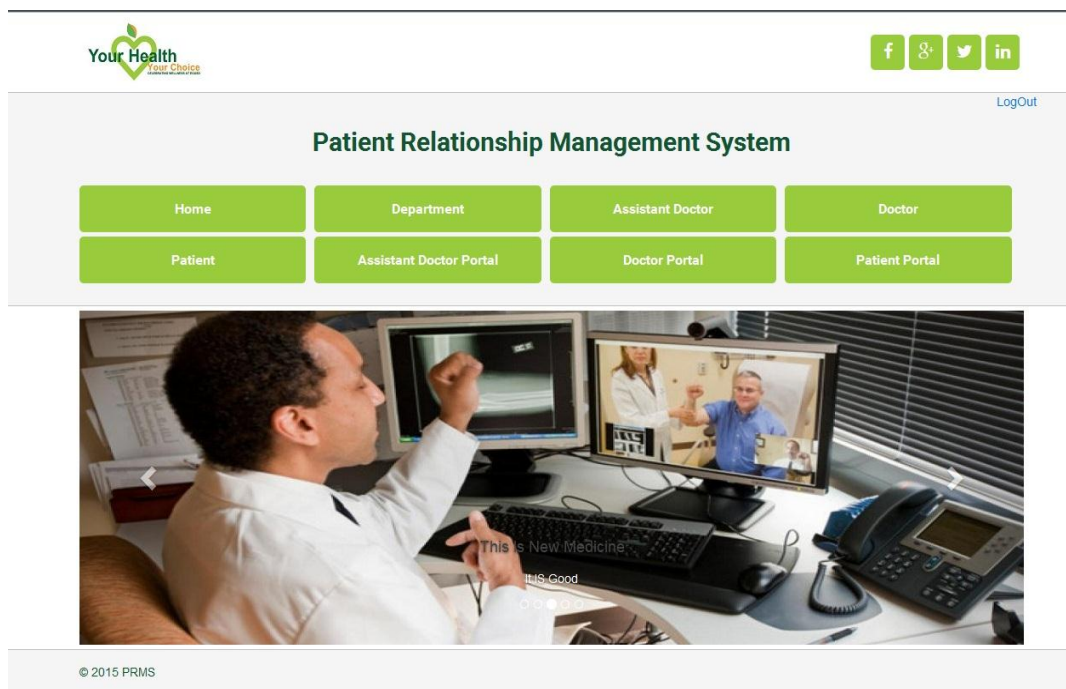
Figure 10: PRMS home page

3.3.3 PRMS Department Page

This page is for department page. All user can see all department list. If any information is not right or need for update then assistant doctor or admin can change and update displaying figure11.

Figure 11: PRMS department page

3.3.4 Assistant Doctor Registration process

This page is for assistant doctor registration process. A new assistant doctor completing registration process he or she need to fill up some required field. After completing this process successfully the assistant doctor will be a registered assistant doctor.

And finally assistant doctor edit his or her profile. After submitting information profile is updated and users also see his or her profile in the view assistant doctor menu.

Assistant Doctor Registration		
ID	:	
User Name	:	
Password	:	
Re-type Password	:	
Assistant Doctor Name	:	
Mobile No	:	
Email	:	
Department	:	---Select---
Image	:	Browse... No file selected.
	[View code]	
	[Type the code]	
Submit		

Figure 12: Assistant doctor registration process

3.3.5 Doctor Registration process

This page is for doctor registration process. A new doctor completing registration process he or she need to fill up some required field. After completing this process successfully the doctor will be a registered doctor displaying figure 13.

Figure 13: Doctor registration process

3.3.6 Doctor View Page

From this page the patient can see the doctor list and they can select and take appointment as their likely doctor from here displaying figure 14.

Figure 14: Doctor View Page

3.3.7 PRMS User Sing up Page Interaction

PRMS Sing up Page is illustrated in Figure 15 which interacts with PRMS Users, User Security and User Type tables of PRMS database

Figure 15: PRMS User Sign Up

3.3.8 PRMS Patient Profile Page Interaction

This page is for patient profile. A patient can see his or her information from this page. If any information is not right or needed for update then he or she can update his or her profile. it is shown below figure no16.

Figure 16: PRMS Patient profile

3.3.9 Patient Appointment Process (not available)

Figure 17 Mention from these page patients can take appointment as their likely doctor if their select department doctor is available on their choosing time and date. On the other hand patients should choose the other doctor or change the appointment date in that department. If the patients don't change the date in a certain time he or she receives a text that this doctor will not available on this date.

Figure 17: PRMS Doctor view page

3.3.10 Patient Appointment Process

From this page the patient can take appointment from their doctor. If the select doctor available on that day. Then the user can show the available confirming result and after pressing the confirming bottom user can confirm the appointment. it is shown below figure no18.

Figure 18: Appointment Process

3.3.11 Assistant Doctor Portal

The assistant doctor can see the registrant patients list by clicking the current patients menu and by giving the right mark fill the yes or no box confirming the patient appointment shown in Figure19. Total registrant will show the patients menu from this. Just like this way day Schedule can be fixed from the day Schedule doctor and finally the assistant doctor can see his or her profile.

Figure 19: assistant doctor portal

3.3.12 PRMS Doctor Portal

Doctor can show the current patients menu form the doctor portal by clicking the registrant patient list shown in Figure20. Doctors can search Patient from patients search menu and at last he or she can show their profile.

Figure 20: PRMS Doctor page

3.3.13 PRMS Prescription Process

From doctor portal, doctor can give their current patient prescription by clicking the prescription button is shown in Figure 21.

Figure 21: PRMS Prescription

3.3.14 Patient and Doctor Videoconferencing

Doctor can Video conferencing with his or her current patient by clicking the Service button from the doctor portal and this way doctors can give prescription to their patients. It is shown below figure no22.
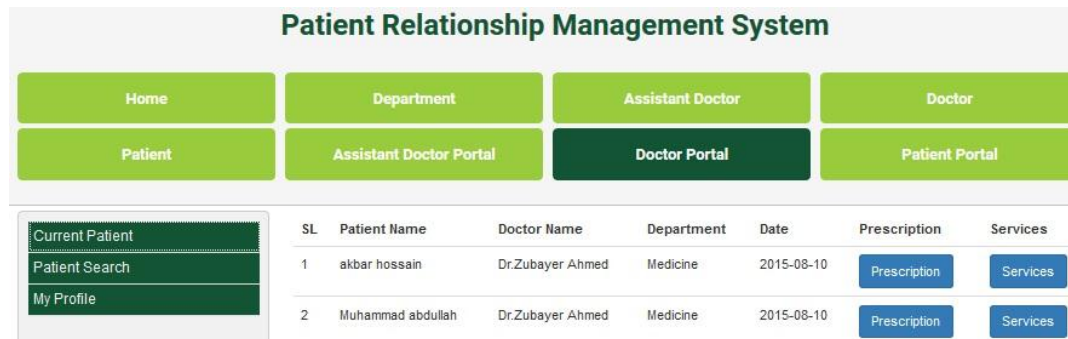
Figure 22: PRMS Videoconferencing

3.4 Implementation

Implementation is the process of realizing the design as a program. Software design is a creative activity in which you identify software components and their relationships, based on a customer's requirements.

3.4.1 Input Analysis

Inaccurate input data are the most common cause of errors in data processing. Errors entered by data entry operators can be controlled by input design. Input design is the process of converting user-originated inputs to a computer-based format. In the system design phase, the expanded data flow diagram identifies logical data flows, data stores, sources and destinations.

3.4.2 Input Data

The goal of designing input data is to make data entry as easy, logical, and free from errors as possible. In entering data, users need to know the following:

• Field sequence, which must match in the source document.

• The format in which data fields are entered.

3.4.3 Output Analysis

Data output is the process and method by which data can be studied under different circumstances and manipulated as required. Data output also involves representation of the data. With the increased of technologies there are many software tools that help in data output.

3.4.4 Feasibility Study

A feasibility study is an evaluation of a proposal designed to determine the difficulty in carrying out a designated task. Generally, a feasibility study precedes technical development and project implementation. In the Feasibility stage, costs of the requirements are determined. For user requirements, the current cost of work is compared to the future projected costs once the new system is in place. Questions such as these are asked: "What are data entry errors costing us now?" Or "What is the cost of scrap due to operator error with the current interface?" Actually, the need for the new tool is often recognized as these questions come to the attention of financial people in the organization.

Some common factors are referred in feasibility study. These are as follows:

• Technical Feasibility

• Software Availability

• Economic Feasibility

• Operational Feasibility

3.4.5 Technical Feasibility

The technical feasibility study compares the level of technology available in the software development firm and the level of technology required for the development of the product. Here the level of technology consists of the programming language, the hardware resources, other software tools etc.

3.4.6 Software Availability

For implementing the project a couple of software is needed. First of all, we need server software which has strong security management. We can use our won server system if possible or we can take part of any professional server provider. Software will need for maintaining the database server. At present we use the My SQL Server.

3.4.7 Hardware Availability

To maintain Telemedicine needs to have an internet facility. We need high speed internet connection with large bandwidth to accept large traffic.

3.4.8 Manpower Availability

To maintain the project the project activities should be checked and observed by technical stuffs. We need administrators to manage any errors caused by user activities and handle the security break up issue. Administrator should be aware of the daily actions and other new updates. We need an IT expert also. IT expert need to professional and able to trace down the incompatibility. Administrator should bear the overall power to maintain the whole system, add/delete anything with the system. As the system contains sophisticated data we need an honest and reliable person as an administrator with superiority over other users.

3.4.9 Economic Feasibility

Economic analysis is the most frequently used method for evaluating the effectiveness of a new system. More commonly known as cost/benefit analysis, the procedure is to determine the benefits and savings that are expected from a candidate system and compare them with costs. If benefits outweigh costs, then the decision is made to design and implement the system. Time Based: This application will save working time and will change the regular working style. Cost Based: Some investment is needed to manage the application. For this application host is needed. And also an IT expert is needed as the manpower.

3.4.10 Operational Feasibility

Operational feasibility study tests the operational scope of the software to be developed. The proposed software must have high operational feasibility. The usability will be high.

3.5 Testing Implementation

3.5.1 Functional Testing

Functional testing means testing the application against business requirements. IT IS executed using the functional specifications given by the client or by the design specifications according to use cases given by the design team. Role of functional testing is to validating the behavior of an application. In functional testing tester has to validate the application to see that all specified requirements of the client whatever we have said in SRS have been incorporated or not. There are two categories of functional testing:

▪ Positive functional testing: testing the application's functions with valid input and also verifying that the outputs are correct.

▪ Negative functional testing: IT involves exercising application functionality using a combination of invalid inputs, some unexpected operating conditions and by some other "out-of-bounds" scenarios.

3.5.2 Testing on Login Form

Users must be passed authentication test through login page. Any attempt with incorrect user id or incorrect password or incorrect both, users will be notified a message regarding "Invalid Username and/or Password" as Figure 23.
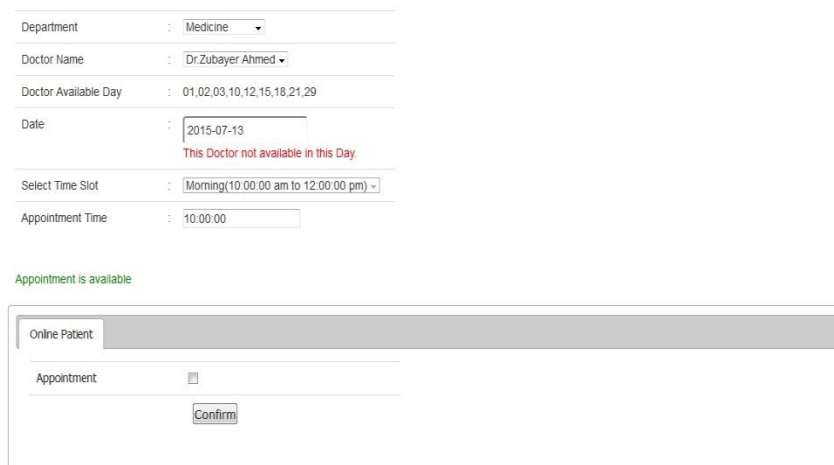

Figure 23: Testing on Login

3.5.3 Testing on Patient Appointment

From this page patients can take appointment as their likely doctor if their select department doctor is available on their choosing time and date. It is shown below figure no24. On the other hand patients should choose the other doctor or change the appointment date in that department .If the patients don't change the date in a certain time he or she view a massage that "This Doctor not available on this Day".

Figure 24: Testing on appointment

3.5.4 Testing on Patient Appointment

If the patients don't change the date in a certain time he or she view a massage that "Appointment is a not available". It is describing below figure no 25.

Figure 25: Testing on appointment

3.5.5 Testing on Patient Appointment Check box

If user doesn`t mark the appointment check box at the time of appointment confirmation then he or she will view a massage "Please Checked Appointment Check Box". It is shown below figure no 26.
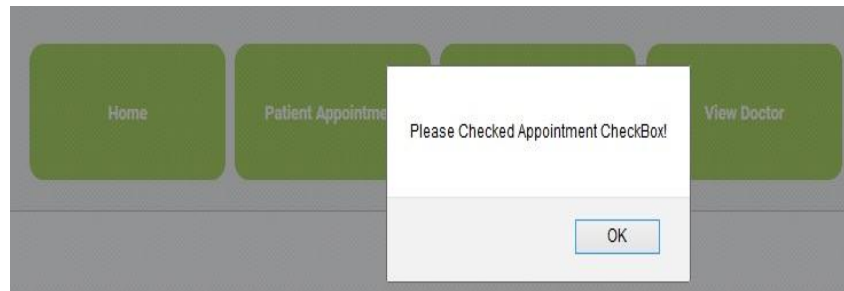

Figure 26: Testing on Appointment Check box

CHAPTER FOUR
Discussion and Conclusion

4.1 Discussion and Future Scope

4.1.1 Discussion

What is Patient Relationship Management? Patient relationship management System (PRMS) brings the concepts of customer relationship management (CRM) to healthcare. This customer-centric strategy and the software that underpins it help organizations to improve customer satisfaction, to reduce costs, to serve their customers better and to improve the overall efficiency of their customer-centric processes.

4.1.2 Telemedicine in Bangladesh: Why?

Bangladesh is one of the most densely populated countries in the world. More than 160 million people are living within 144,000 square km of land. In 2015 the total number of hospitals in Bangladesh was 1683. Of these 1683 hospitals, 678 were government hospitals and 1005 were non-governmental. Around 80% of the total population of this country lives in rural areas. And rural health centers are often ill-equipped for proper medical treatment. Moreover most of the doctors are city based. After being selected as a cadre of Bangladesh Civil Service (BCS) usually get employment in remote health center of Bangladesh. Due to poor infrastructure of rural health center and poor infrastructure of villages most of them leave the rural areas within 1-2 years and shift to city area. They feel that they become professionally isolated and outdated if stationed in remote areas. As a result health staffs in rural areas are usually young, have little work experience and show high job rotation. In many cases rural Health Centers are headed by infirmary technicians who are barely trained. In this situation rural people rarely get any specialist doctor's advice when they go to health centers in Thana or Upazila level. To get better consultancy rural people spend most of their money on travel to visit doctor in urban areas instead of meeting other treatment expanses. Sometimes, it is not possible to transfer a patient to

the suburb or to the city on time due to his/her critical health condition and poor communication facilities in those areas.

Under this circumstance to provide health care in rural area there is two option. One is, building hospital in rural areas and also improves the infrastructure so that doctors and others staffs feel convenient to stay at that places. Another one, is to take any initiative so that it is easy to access quality of health care to rural areas. To implement first one needs huge investment and time. So remaining is second one. To implement second one telemedicine is the best away to provide better health care by using maximum utilization of limited resources [19].

4.1.3 History of Telemedicine in Bangladesh

Telemedicine in Bangladesh emerged in before 1999.Many Bangladeshi physicians and surgeons were practicing informal Tele-consultation with their colleagues in different countries. The early initiatives were sporadic and unorganized and most of them were based in store and forward technologies such as telegram and e-mail basis. A more formal approach was taken only since 1999.

4.1.4 Time Line of Telemedicine in Bangladesh

▪ 2004 – 22nd January: organized and sponsored the 1st International Conference on eGovern ment, eHealthcare and eLearning jointly with the Prime Minister's Bureau for Support to ICT Task Force of the Government of Bangladesh.

▪ 2005 – 5th June: TRCL demonstrated successful medical call center system using mobile phone infrastructure and text messaging systems.

▪ 2006 – 5th January: signed the strategic partnership agreement with Graeme Phone Ltd. for Medical Call Center project.

▪ 2007 – 12th February: HealthLine – the first medical call center manned by licensed physician jointly with Graeme Phone Ltd. was awarded with GSMA Global Mobile Award 2007.

▪ 2009 – 26th June: ICDDR, Bangladesh (www.icddrb.org) and Johns Hopkins School of Public Health (on behalf of Future Health Systems) and TRCL have signed an agreement to initiate IRHIS (Integrated Rural Health Information System) project.

- 2009 – 17th October: TRCL has celebrated successful completion of 1st decade in Telemedicine, eHealth and health businesses.
- 2009 – 3rd November: TRCL launched chronic disease management system under "AMCARE" brand in Bangladesh. In first phase, TRCL Diabetes Patient Management System (DPMS) and Mobile Applications were introduced.
- 2010 – 26th April: signed an exclusive collaboration agreement with Diabetic Association of Bangladesh to extend diabetes care nationwide to bring 100% diabetic patients under treatment and monitoring using TRCL patient management platform and medical call center system.
- 2010 – 14th July: TRCL and Diabetic Association of Bangladesh jointly under a grant from World Diabetes Foundation formally launched Accredited Physician Scheme (APS) to train, equip and deploy 500 rural certified physicians in all sub-districts of Bangladesh, who will practice as rural diabetic care centers.
- 2011 – 2nd June: TRCL launched pilot scheme in collaboration with ICDDR,B and JHSPH funded by DFID (UK) to include village (traditional) doctors under medical call center system of TRCL.
- 2011 – 10th July: TRCL launched medical call center service in Singapore for Bangladeshi expatriates [18].

4.1.2 Future Scope

With a patient relationship management System, ongoing relationships can be established between clinicians and patients that can increase the focus on prevention and help improve overall health. Patient care that crosses departments or organizations can be better coordinated, leading to increased patient satisfaction and well-being. Patient interaction processes can be analyzed and streamlined to better meet patient needs and increase efficiency.

4.2 Conclusion

A follow-up treatment system seems to be a tool to create and maintain better communication with the patients rather than just a technological solution. It seems to enable a more patient-oriented treatment and personalized care. Physicians may follow the treatment processes from the very beginning till when a patient returns to work. All of this may help move toward determining more closely the patients' needs and providing them with better care. A system may help better understand and analyze both individual patients and patient groups. The PRM applications may also be utilized to manage the information at the hospital level.

In summary, PRMS applications provide an interesting opportunity for further research, in particular when integrated with other hospital information systems.

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