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E-HEALTH MANAGEMENT SYSTEM

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BSC HONORS IN INFORMATION TECHNOLOGY

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I would like to express our gratitude to my supervisor **Dr. JHON SNEL** for the useful comments, remarks, engagement and all support through the learning process of this Final Year Project. He has been a constant source of guidance throughout the course of this project. I would like to thank my loved ones, who have supported us throughout the entire process, both by keeping me harmonious and helping me putting pieces together. I will be grateful forever for your love.

Husnain Azeem Toor

Abstract

Most of the reasons for implementing the EHMS (Electronic Health Management System) focus on improving medical care as a whole for Patient, Physicians and Doctors. However, achieving an excellent quality of best medical care through EMR (Electronic Medical Record) is neither low-cost nor easy. Based on our qualitative study on physician practices we have found that quality improvement depends heavily on doctors' use of the EMRs, not use of papers for their daily tasks. I also identified Key barriers to physicians' use of EMRs and also observed that EMR software becomes useless for doctors due to its complex interface. E-Health Management System for Outdoor patient is the complete comprehensive solution for hospitals and clinics. This solution caters the full life cycle of modern hospitals and clinics, using this system patients can take appointment form their homes and confirm the availability of particular doctors. A consultant can access the medical record of their patient, and prescribe to their patient using this system.

In this FYP document, I have briefly described all the phase that it has gone through from its inception to the implementation. I have highlighted the key features of E-Health Management System for OPD (Outdoor Patients).

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1. Chapter: Introduction

The rapid growth in Information & Communication Technology (ICT), and the power of Internet has strongly impacted the business and service delivery models of today's global environment. Health Management Systems provide the benefits of streamlined operations, enhanced administration & control, superior patient care, strict cost control and improved profitability. Hospital Management Systems are in high demand to handle increasing population needs and also aids the practicing doctors and hospital service and support staff with timely service and precision. There are varied metrics available to assess the performance of services like hospital industry, and the successful implementation and usage of Hospital information system forms a crucial role [1]. My Cloud based web application of **E-Health Management system** will provide comprehensive, effective and efficient solution for carrying out management of hospitals and clinics fulfilling the needs and requirements of all stakeholders such as doctors, patients and staffs.

This chapter will explain following:

- Motivation
- Problem
- Existing Systems as Solutions
- Proposed System
- Goals
- Objectives
- Benefits from EHMS
- Stakeholders

1.1 Motivation

We do not usually visit hospitals unless we need to but this visit does not always gives us good experience as we face various problems there. There are automated hospital management system but they do not provide any functionality for us. Even the doctors do not have access to their patient's data while they are at home. It will be great for the patients to have an application that will keep them close to their personal data like: prescriptions, test reports and other important materials. Patients will be able to browse through all the available doctors and ask for appointment for their desired doctor. A doctor will also experience the similar benefits. This will reduce a lot of paper works and make things easy for everyone associated with it. I have some personal experience visiting the hospital.

People experience their worst nightmare while they need to visit the hospital. No body visits the hospital unless it is extremely necessary. People become frustrated because of poor management system. This gave me the perfect motivation to build something for them and offer them some help at their most needed time. I am confident that this product can and will help them.

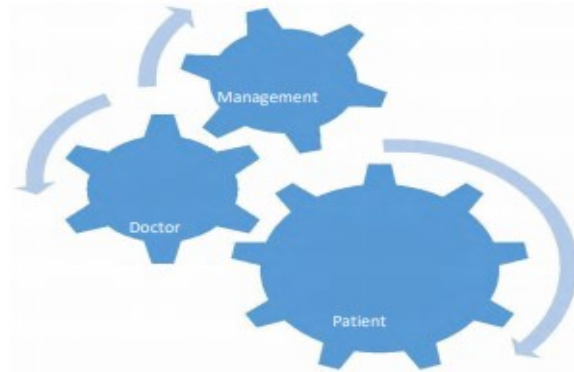


Figure 1-1

1.2 Problem

We know hospital deals with the life and health of the patient. An excellent medical care relies on well-trained doctors, nurses and high-quality facilities and equipment, and also relies on good keeping records. Diseases are increasing day by day, so it is tough for physicians to prescribe the patient, one wrong decision can lead to patient death.

In most of the hospitals records about patient's ailment is being to save on papers, so retrieve of the patient history is tough and manually search record takes a lot of times and efforts, and major problems in hospitals are, the patient does not care about their medical records. They lose their medical files (Prescriptions), the result of which is the patient have to retest and re-check up again according to his diseases.

Without accurate, comprehensive and up to date patient medical record a doctor may engage in many troubles to find the actual cause of the patient disease. In other words, medical personnel may not offer the best treatment or may lead to misdiagnosing to the patient. Record keeping is an important aspect of any organizations in their day to day operation. Good records also ensure that hospitals administration run smoothly [2].

1.3 Existing Systems as Solutions

There are couple of Hospital Management Software are currently present, I will discuss two of them as follows:

- Hospital Management Software (Tirupati International) [4]
- INSTA HMS Hospital Management System (ACG Infotech) [5]

Common Features:

All these systems have the following common functionalities:

- Appointment Management
- Billing & Invoicing
- Claims Management
- Patient Management
- Patient Records Management
- Physician Management
- Policy Management

Comparison (Pros and Cons)

Hospital Management Software (Tirupati International)

Pros:

This system provide functionalities of appointment system, patient record facility, doctor's management, billing and policy management system.

Cons:

This system is offline system and run locally. We need local area network to use this software. It's not user friendly. Users' needs training to get understanding of use of this software which increase cost. User needs to be in hospital to check any information. There is no remote access to this system. Patient have to contact hospital to take appointments. There is no online appointment systems which is very inconvenient for patients.

INSTA HMS

Insta HMS is a cloud/web-based application for hospital management.

Pros:

Insta HMS is a cloud/web-based application which covers all financial, clinical and operational requirements of a hospitals. This system provide functionalities of appointment system, patient record facility, doctor's management, billing and policy management system. Its user friendly and mobile app contains all the modules required. It provides everything under one platform, doctor visits, appointments everything is managed periodically. It can be accessed anywhere with internet connection.

Cons:

Doctors scheduling is very poor. Individual doctors has to type dates and time which is not user friendly. It requires typing inputs for most of its process such as assigning medicines. It does not has appointment reminder system for patients. Users' needs training to get understanding of use of this software which increase cost. There is no document or guideline videos for using this software.

1.4 Proposed System

After extensive research had been carried out on hospital management process, I proposed cloud based web application for E-Health Management System which will provide comprehensive, effective and efficient solution for carrying out management of hospitals fulfilling the needs and requirements of all stakeholders such as doctors, patients and staffs by providing following features.

- Patient Appointment Management
- Doctors appointment scheduling
- Identify and maintain patient records
- Manage patient medical history such as reports, prescriptions, laboratory tests, etc.
- Electronic Prescriptions for a doctor
- Patient medical records Security and privacy
- Physician Profile Management
- Appointments reminder management
- SMS Dose reminder for patients
- Patient Billing management
- Data segregation for the researcher of the epidemiology

[1-10]

1.5 Goals

The E-Health Management System has following goals:

- **Planned approach towards working:** - The working in the organization will be well planned and organized. The data will be stored properly in data stores, which will help in retrieval of information as well as its storage.
- **Accuracy:** - The level of accuracy in the proposed system will be higher. All operation would be done correctly and it ensures that whatever information is coming from the center is accurate.
- **Reliability:** - The reliability of the proposed system will be high due to the above stated reasons. The reason for the increased reliability of the system is that now there would be proper storage of information.
- **No Redundancy:** - In the proposed system utmost care would be that no information is repeated anywhere, in storage or otherwise. This would assure economic use of storage space and consistency in the data stored.
- **Immediate retrieval of information:** - The main objective of proposed system is to provide for a quick and efficient retrieval of information. Any type of information would be available whenever the user requires.
- **Immediate storage of information:** - In manual system there are many problems to store the largest amount of information.
- **Easy to Operate:** - The system should be easy to operate and should be such that it can be developed within a short period of time and fit in the limited budget of the user.

1.6 Objectives:

The E-Health Management System has following goals:

- Authorize doctors and assisting staffs to access the medical history of patient efficiently
- Appointment and reminder system for Patients
- To build a built-in medical solutions repository on the basis of historical and statistical data
- To let the doctors and surgeons build their profile and personal repository in which they may store their routine medicines names, precautions instructions and can take required help from this repository later when needed.
- Generate reports for researcher of the epidemiology

1.7 Benefits of EHMS:

E-HMS will provide following benefits:

- EHMS enable doctors in clinic or hospitals to store and retrieve detailed information of a patient which have to be used by health care providers during an inpatient hospitalization.
- EHMS save the time of patient during in finding a doctor or a physician's clinic visit.
- In the case of emergency, comprehensive patient's record can provide valuable, life-saving information to the emergency department.
- EHMS help to improve the communication between physicians, allowing each party to fully access the patient's medical history rather than a snapshot- type overview from the current visit. This access allows for more in-depth evaluation and enables doctors to reach an accurate diagnosis more quickly.
- Reducing medical errors of patient medical records is, of course, a tremendous benefit to each doctor and patient. An EHMS can record info and eliminates the downside of lost and misplaced patient medical records.
- The electronic record can provide current up-to-date patient's medical full history, including currently ordered test and test results from the laboratory and the recommendations of other physicians.

1.8 Stakeholders

The following table will describe all the stakeholders and their primary functions[8].

Stakeholders	Type	Description
The patient	Primary End user of the system	Uses System to access his medical record
The Doctor	Primary End user of the system	Uses System to access to prescribe to patient
The Nurses	End user of the system	Uses system to manage patient's vital signs
The Phlebotomist	End user of the system	Uses system to manage patient's pathology test as well as X-ray
The Receptionist	End user of the system	Uses System to manage patient's billing
The Admin	Administrator user of the system	Manage Users of HMS

Table 1-1

2 Chapter: Feasibility Report

When a project is started the first matter to establish is to assess the feasibility of a project or product. Feasibility means the extent to which appropriate data and information are readily available or can be obtained with available resources such as staff, expertise, time, and equipment. It is basically used as a measure of how practical or beneficial the development of a software system be to you (or organization). This activity recurs throughout the life cycle.

There are many types of feasibilities:

- Technical
- Operational
- Economic
- Schedule
- Specification
- Information
- Motivational
- Legal and Ethical

2.1 Technical Feasibility

E-HMS is a comprehensive IT solution for keep track the medical history of patients in particular hospital or clinic; Nobody can deny the importance of patient medical history. Our aim to provide to people, a secure and easy way to keep track of their medical history, providing access to their lab results, prescriptions, Xrays, etc.

E-HMS is a web base project, Consultants or patients requires only one PC with an internet connection using this system, web base projects have a significant advantage is access everywhere at any time so both patient and consultants can use this system 24 hours in a day.

However, there are risks for using a web-based system. Once the E-HMS's users lose its Internet connection (due to hardware failure, maintenance, or ISP problems) they remain unable to use this System such as Consultants does not be able to view the patient history because it is almost paperless.

2.2 Familiarity with Technology

The use of technology (PHP) for Management System is very high, our system (E-HMS) is also management system, and I have great skill in PHP so, therefore, I have not faced any problem using this technology.

Look and feel of any product have a large impact of product sale, as well as product use. one of our group member, have high skills in HTML, CSS, and JavaScript, so I provide magnificent layout of E-HMS system.

2.3 Operational Feasibility

In most of the hospital's records about patient's ailment is being to save on papers and other present systems, so retrieve of the patient history is tough and manually search record takes many times. The efforts and major problems in hospitals are, the patient does not take care of their medical records (Prescription reports, Pathology test reports, X-rays) and lose records, so these valuable information does not available when it requires.

2.4 Economic Feasibility

I have conducted economic feasibility studies of the current (EMR) Systems (By using systems online). The result of this types of Systems (patient EMR) does not require any additional hardware. Since this system is going to be developed using the existing resources and technologies, so the system is highly economical.

Benefits from this project:

E-HMS will provide following benefits:

Benefits to patients:

- E-HMS enable doctors in clinic or hospitals to store and retrieve detailed information of a patient which have to be used by health care providers during an inpatient hospitalization.
- E-HMS save the time of patient during in finding a doctor or a physician's clinic visit.
- In the case of emergency, comprehensive patient's record can provide valuable, life-saving information to the emergency department in EGH care provider.
- E-HMS help to improve the communication between physicians, allowing each party to fully access the patient's medical history rather than a snapshot- type overview from the current visit. This access allows for more in-depth evaluation and enables doctors to reach an accurate diagnosis more quickly.

Benefits to health care providers

- Reducing medical errors of patient medical records is, of course, a tremendous benefit to each doctor and patient. An E-HMS can record info and eliminates the downside of lost and misplaced patient medical records.
- The electronic record can provide current up-to-date patient's medical full history, including currently ordered test and test results from the laboratory and the recommendations of other physicians.
- Increase the health care provider's revenue by advertising their consultants.

2.5 Schedule Feasibility

- The time scheduling of this project is paramount. Meeting deadlines and milestones always be kept in mind. I have need to learn the technologies like asp.net core, Bootstrap, Jason, so learning curve not impact on our schedule and our deadline are mandatory, so I schedule our project by following
- Gantt and PERT charts;

2.6 Specification Feasibility

In this project, I am going to maintain the patient medical record. On the basis of this information, our project goes to build. Moreover, I have a specific user with their defined functionalities, so there is no ambiguity about the user needs as they are pre-specified to us and clear from the implementation perspective.

2.7 Information Feasibility

I have gathered the information online and consulting with highly qualified staff of hospitals. The information is very much reliable because all the staff members of these hospitals and clinics are experienced and highly expert in their related fields and departments, as I am much clearer with our requirements, so the information is complete as well.

2.8 Motivational Feasibility

The E-HMS is not only the product that maintains the patient record rather it is life-saving for the patient in critical time. Hospitals and clinics will accept this product on completion as it is comprehensive and complete solution to carry out the operation of their hospitals and clinics efficiently and effectively.

2.9 Legal & Ethical Feasibility

I am ensuring that there are no infringements or liabilities arise from this project. One ethical issue inpatient EMR is that one patient or any other person except hospital's consultant cannot be able to view patient medical record without his permission. I overcome this issue by providing individual account information for every user. I make sure that it must not have destructive effects on our ethical values and also our society [11].

3 Chapter: E-HMS Planning and Management

Project management is a one-time carefully planned and organized effort to achieve a specific goal. Project management includes: developing project plan, which includes defining project goals and objectives, specifying tasks or how goals will be achieved, what resources are need, and associating budgets and timelines for completion and implementing the project plan, carefully to make sure the plan is being managed according to the plan [12].

This chapter has following outlines:

- Project Development lifecycle:
- Life Cycle Chart:
- E-HMS Life Cycle Giant Chart:

3.1 Project Development lifecycle:

Project management usually following major phases shown in Figure 3-1:

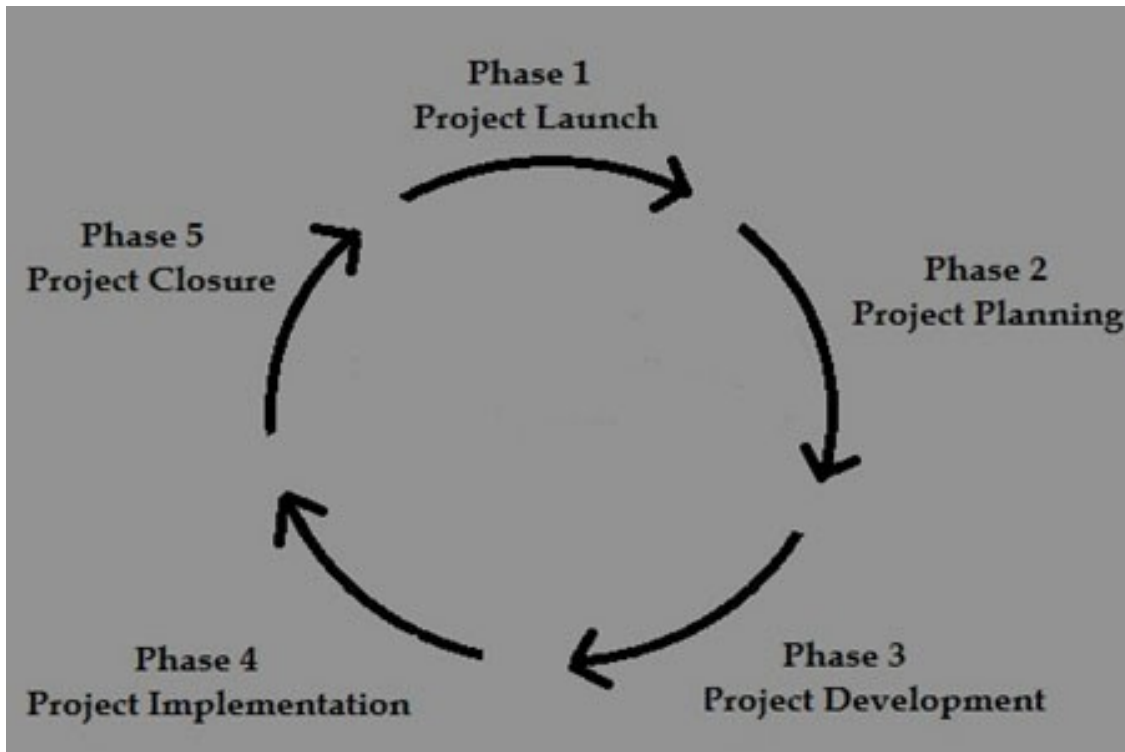


Figure 3-1

Project initiation

Project initiation is the opening point in the 5 steps of E-Health Management System project development life cycle and in simple terms: starting up the project. I initiate a project by defining its reasons, business goals, and scope. The reason for initiating it, and the purpose solution to be implemented. I will also put together a project team, defined early milestones and early budget proposal. With the above information I can move on and perform an end of phase study in order to get a GO on GO decision.

Project planning

Once I define the project, I am ready to enter the in depth project planning phase. This involves creating the PMP project management plan in order to have guide during the project development and after.

Development

After complete planning of the project, I developed actual design of the project. This includes all case diagrams, activity diagrams, sequence diagram. And also i sketched blueprint of our project i.e. database schema, types of hardware and software required for project development.

Implementation

With a comprehensible characterization of the project and the full and detailed PMP, I am now ready to enter the Execution phase of the project. This is the stage in which the requirements are actually built and programmed. After the QA process the product will be presented to the customer for acceptance and full implementation. If the customer has accepted the final product, the project is complete and ready for closure.

Project Closure

Project Closure involves releasing the final product to the customer, handing over project documentation, Manuals, Source code, and Network layouts. Last remaining step is to undertake a Post Implementation Review to identify the level of project success and note down any lessons learned.

Project Deliverables

Project deliverables are work products produced as requirement elicitation. The following is the list of the deliverables those are to be delivered to the stakeholder at regular interval of time. The list consists of the outcome/result obtained at the end of each phase of SDLC.

3.2 Life Cycle Chart:

The following (Table 3-1) will demonstrate the task, their start date, duration and completion date.

TASKS	START DATE	Duration	FINSH DATE
Requirement Gathering	20.8.18	17	06 September 2018
Preparing Product Description	6.9.18	9	15 September 2018
Identify Problems in Current System	15.9.18	5	20 September 2018
Initial Purposal	20.9.18	8	28 September 2018
Define Scope	28.9.18	2	30 September 2018
Project Feasibility Report	30.9.18	10	10 October 2018
System Analysis	10.10.18	41	20 November 2018
Define Detailed Features	10.10.18	5	15 October 2018
UML Diagram	15.10.18	17	01 November 2018
Requirement Elicitation (Sequesnce Diagrams)	1.11.18	19	20 November 2018
Deliverable	20.11.18	23	13 December 2018
System Design WireFrames	1.12.18	31	01 January 2019
Theme Making	1.1.19	4	05 January 2019
Web App Index Page	5.1.19	3	08 January 2019
Implement Doctor Panel	8.1.19	92	10 April 2019
Implement Patient Panel	1.2.19	47	20 March 2019
Implement Phlebotomist Panel	2.3.19	8	10 March 2019
Finalizing Front End	10.4.19	10	20 April 2019
System Testing	1.3.19	55	25 April 2019

Table 3-2

3.3 E-HMS Life Cycle Giant Chart:

The following (Figure 3-2) describes the life cycle of E-HMS in Giant chart.

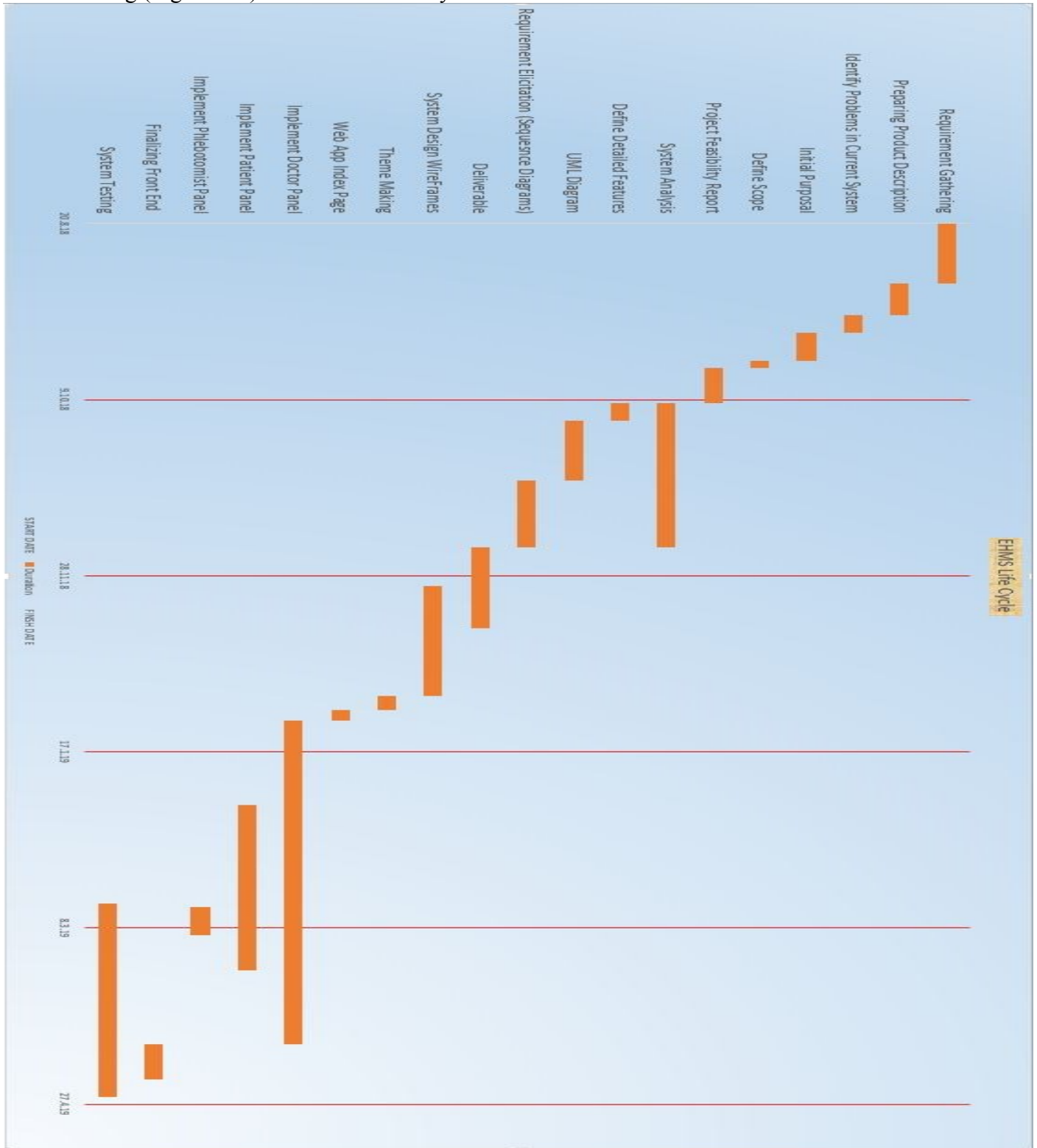


Figure 3-3

4 Chapter: System Analysis

In this chapter, I will describe the system analysis phase of E-Health Management System. In this phase, I describe the detailed features, develop data flow diagram, work flow diagram, use case diagram and the sequence diagrams for different modules of our project we divide the application into different modules [13].

This chapter has following outlines:

- System features
- Data flow diagram
- Work flow diagram
- High level use case diagram
- Sequence diagrams

4.1 System features:

After extensive research had been carried out on hospital management process, E-Health Management System will have following features:

Patient Appointment Management

Patient appointment management section will have following features:

- Book appointment
- Search doctor
- View available time slots of the doctors
- Multiple appointments
- Cancel appointments
- Request for emergency appointment
- Appointment confirmation
- Appointment reminder

Doctors appointment scheduling

Doctor's appointment scheduling section will have following features:

- Doctor today's appointments schedule
- Doctors tomorrow appointments detail
- Cancel appointment
- SMS text detail about tomorrow appointments to doctor
- total examined appointments

Identify and maintain patient records

Identify and maintain patient record's section will have following features:

- Search patient
- Patient total visit to hospital
- Patient total visit to a particular doctor
- Patient personal detail
- Edit patient personal detail
- Add new patient
- Assigning Medical registration number (MRNO) to each patient.
- Generating patient MRNO card
- Unique Barcode based MRNO card

Manage patient medical history such as reports, prescriptions, laboratory tests, etc.

This section will have following features:

- Patient recent prescription
- Patient old prescriptions
- Order laboratory for particular ABC test of a patient

Electronic Prescriptions for a doctor

This section will have following features:

- Readymade prescription
- Prescription management for doctors

Physician Profile Management

This section will have following features:

- Add doctor
- Delete Doctor
- Update doctor
- Doctor registration number(DRNO) management
- DRNO Barcode based card

Appointments reminder management

This section will have following features:

- Patient appointments reminder management
- SMS based appointments reminder for patient
- Doctor appointments reminder
- Add reminder for particular time
- SMS based appointments reminder for doctor
-

Patient Billing management

Data segregation for the researcher of the epidemiology

This section will have following features:

- Search for a specific disease
- Search for the patients of a particular area
- Search for the cure of the specific disease
- Search for the cure of the specific disease of a particular field.
- Diagnose and investigate health problems and health hazards in the community.

4.2 Data Flow Diagram:

The following data flow diagram (Figure 4-1) is representing a flow of a data of an E-Health Management System process. The detailed process has been described in sequence diagram.

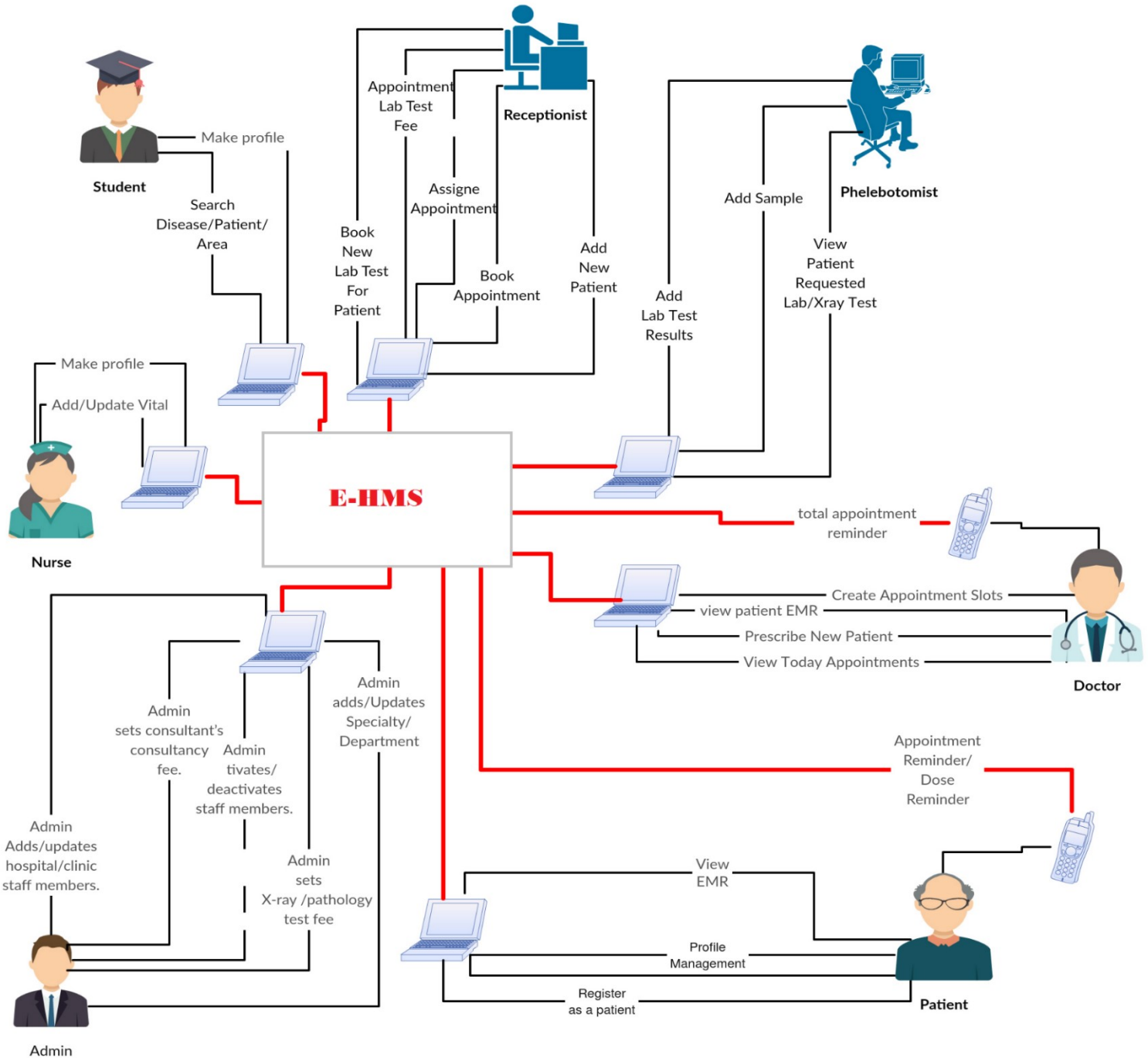


Figure 4-2

4.3 Work Flow Diagram

The following work flow diagram is representation of an E-Health Management System business process. This diagram (Figure 5-3) describes the exact steps needed to complete a process.

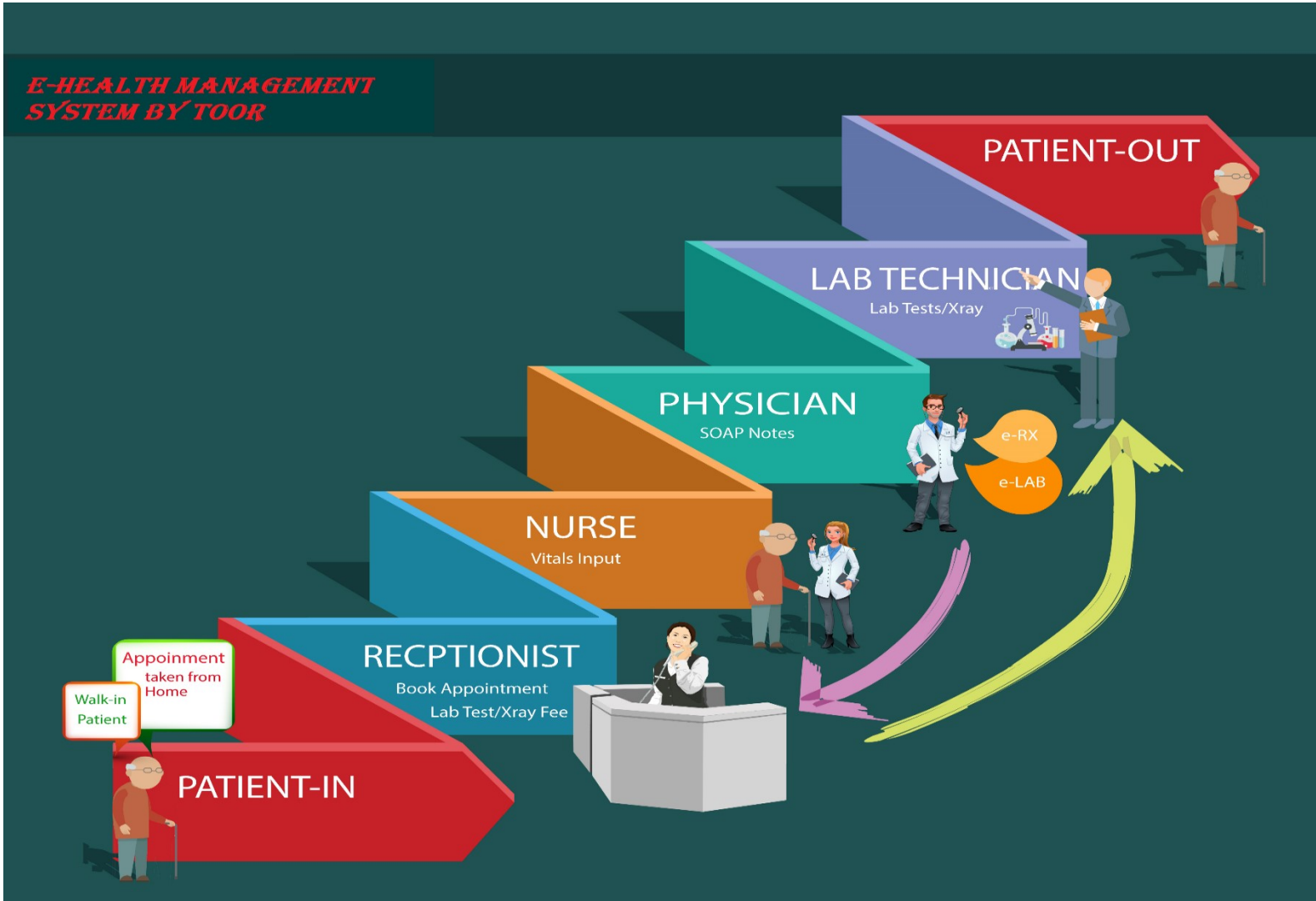


Figure 4-3

4.4 High Level Case Diagram

The following use case diagram (Figure 5 4) depicts a high-level overview of the relationship between use cases, actors, and the system of E-HMS.

uc UMLUseCaseDiagram1

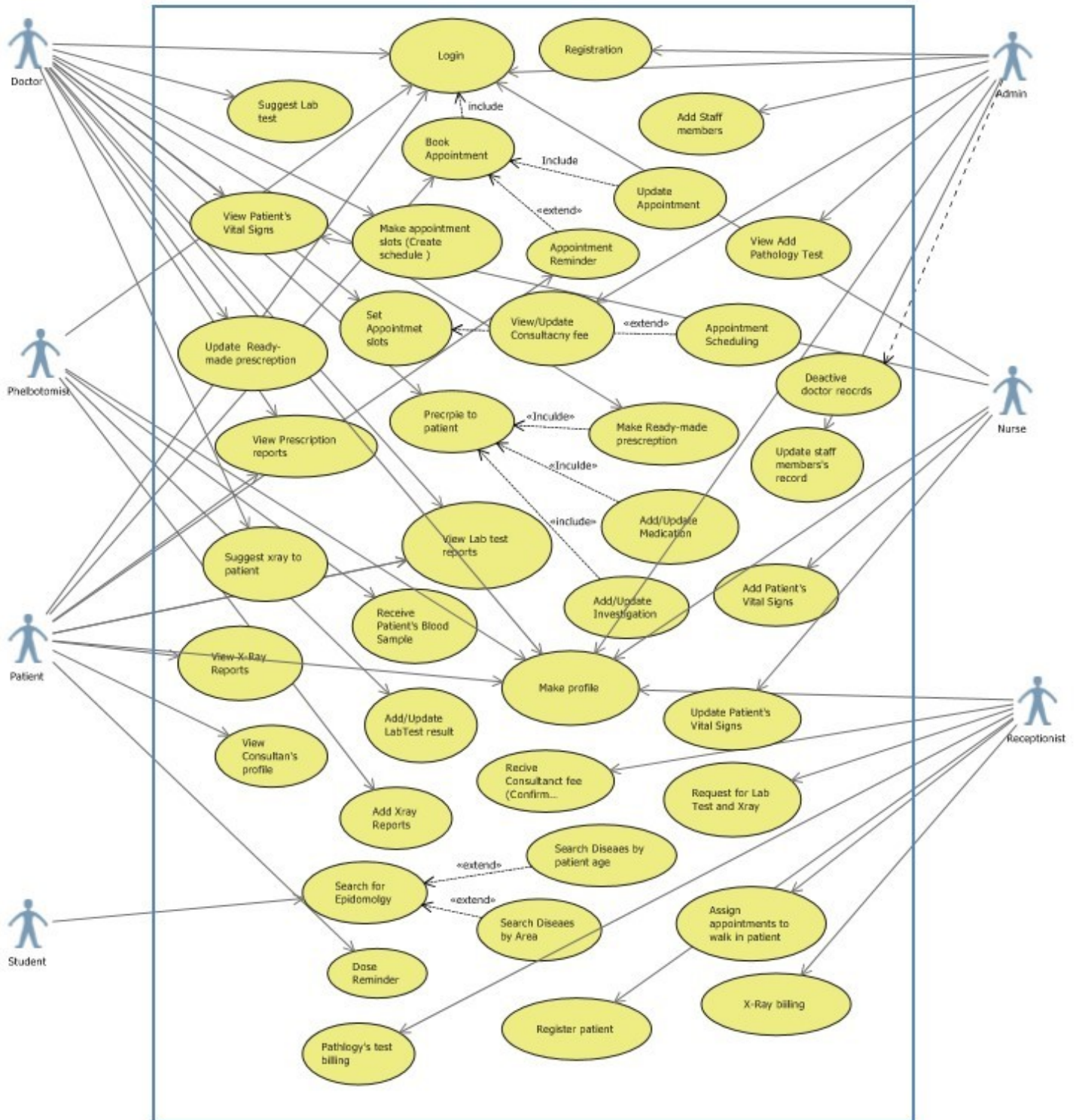


Figure 4-4

4.5 Sequence Diagrams

The following sequence diagram depicts the objects and classes involved in the scenario and the sequence of messages exchanged between the objects needed to carry out the functionality of the scenario [14]. All the sequence diagrams for all possible scenarios has been shown as follows:

1. Login:

This case describes how a user logs into the E-Health Management System.

Actor: Admin, Doctor, Patient:

Precondition: None

Postcondition: If the case was successful, the actor is now logged into the system, if the case remains unsuccessful system state remain unchanged.

Main success scenario:

- 1: The actor select login option on the home page.
- 2: The System display the login page.
- 3: The actor enters his/her name and password.
- 4: The system validates the entered user name and password.
- 5: The System logs the actor into the system.

2. Registration (Account registration):

This case describes how actor registers himself/ herself into the E-Health Management system.

Actor: Doctor, Patient:

Precondition: None

Post-condition: If the case was successful, the actor is now registered actor into the system, if case remains unsuccessful system state remain unchanged.

Main success scenario:

- 1: The User select an option for register himself.
- 2: The System Display Account registration form having (username, password, and Confirmation password fields).
- 4: The actor enter account registration information (Username, Password) and select an Option to save the record.
- 5: System displays message “Register successfully”.

3. Make profile:

This case describes how users (Patients, doctors, Nurses, Phlebotomists, Student) make their profile into the E-Health Management system.

Actor: Doctor, Patient, Nurses, Phlebotomists:

Precondition:

- The user must have registered his/her account.

- The user must be logged into System.

Postcondition: If the case was successful, the actor becomes able to make their profile successfully.

Main success scenario:

1. The new patient logged into system
2. The System Display user registration form having (Name, Email, phone,
 3. Address, gender, Date of birth)
4. The user (Doctor, Patient, Nurses, and Phlebotomists) enters all the mandatory field (First
 5. Name, Email, phone, Address , gender, Date of birth)
6. The user selects an option to save the record match”

4. Book Appointment:

This case describes how a patient can take appointment from his/her desired doctors as show in (Figure 5-5).

Actor: Patient

Precondition: Actor (patient) must be registered and must have to be login into the system.

Basic flow:

1. The patient selects an option to book an appointment.
2. List of doctors with their details will be displayed.
3. The system Display the doctor appointment slots with times. The patient select the appointment time and click on submit button.
4. The system displays the message “appointment book successfully” and System sends an alert message to the patient mobile device to confirm his/her appointment by coming to the hospital “Reception” before half hour on the selected time slots.

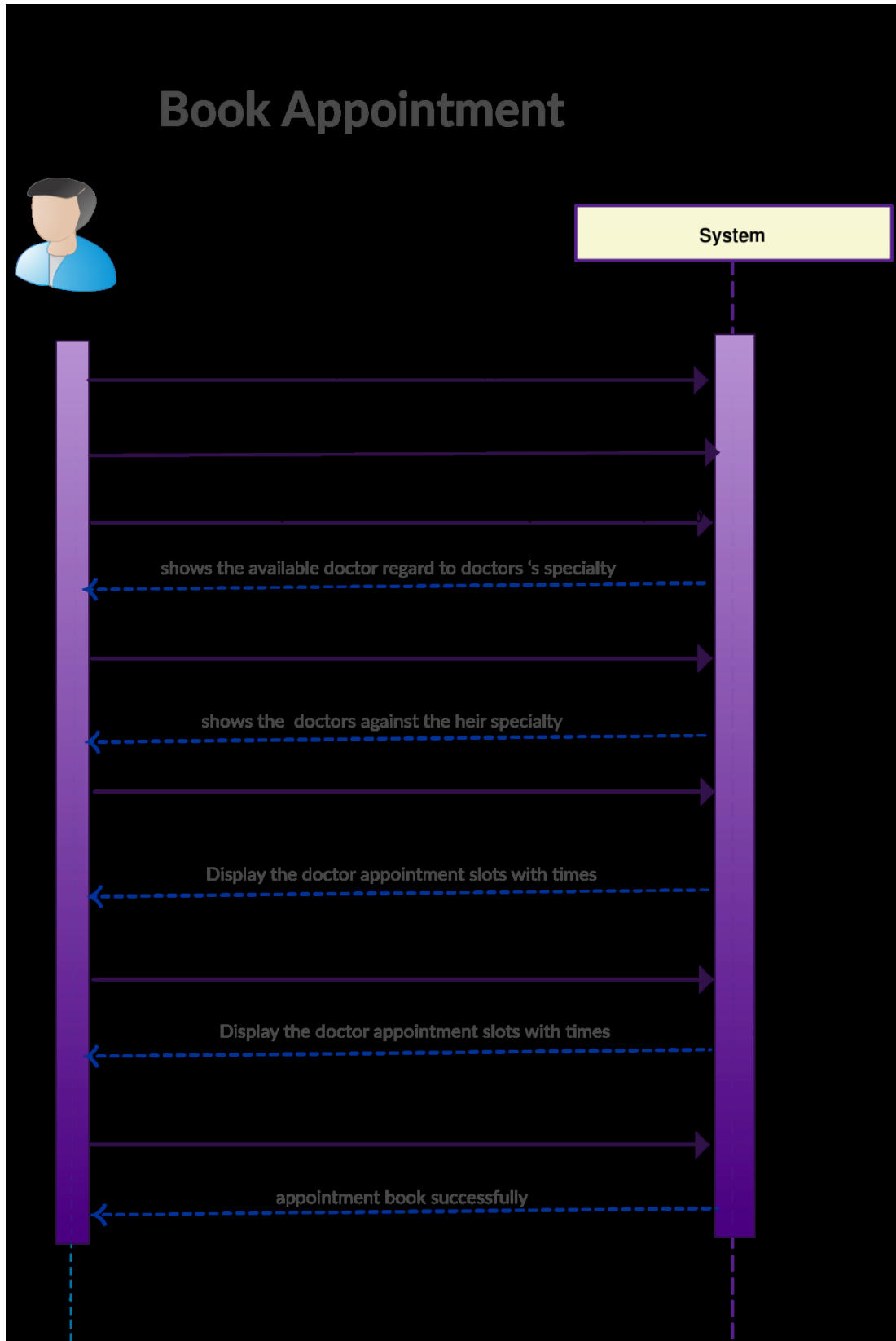


Figure 4-5

5. View Prescription Reports (Medical history)

This is a case in which patients can view their medical history (Previous prescription). Only registered patients can view their medical history as shown in (Figure 5-6).

Actor: Patient

Preconditions:

- The actor must already have a login to the system.
- The patient must already have a unique id to the system.

Postcondition: If the case is successful, the actor is now able to get his medication history from his account. If the case remains unsuccessful, the system state remains unchanged.

Main success scenario:

1. The actor selects an option to view medical history.
2. The system displays all previous prescriptions having (Appointment Date or Patient checkup date, Doctor Name, Patient's Diseases,) of logged-in Patients.
3. The Patient selects an option to view the prescription details (Patient diseases, patient's symptoms, suggested medicine, recommended pathology Test).
4. The system displays the prescription record's details having (Patient diseases, patient's symptoms, suggested medicine, recommended pathology Test)

View Prescription Report

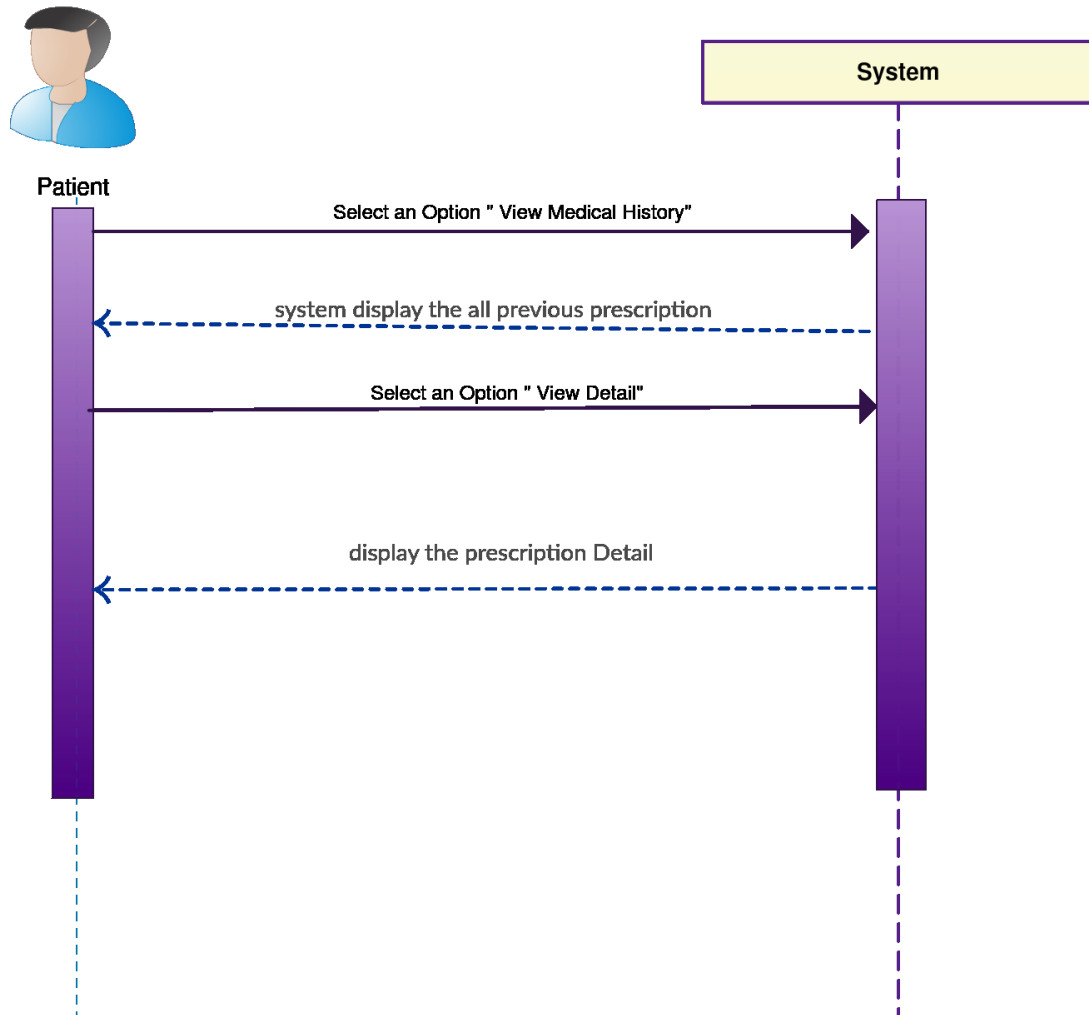


Figure 4-6

6. View Medical Tests

In this case, patients can view his/her pathology test and their results as shown in (Figure5-7).

Actor: Patient

Preconditions:

The actor must already have a login to the system.

Postcondition: If the case successful, the patient able to view his Pathology test in Health Managment.

Main success scenario:

1. The actor select an option to view Lab Test.
2. The System display all Pathology test having (Recommended Doctor Name, Patient test Name, Patient test Component name, Test date).
3. The Patient select an option to view the pathology test result (test name, Values, frequency).
4. The system display the Pathology Test record's details having (Test name, Values or result, frequency).

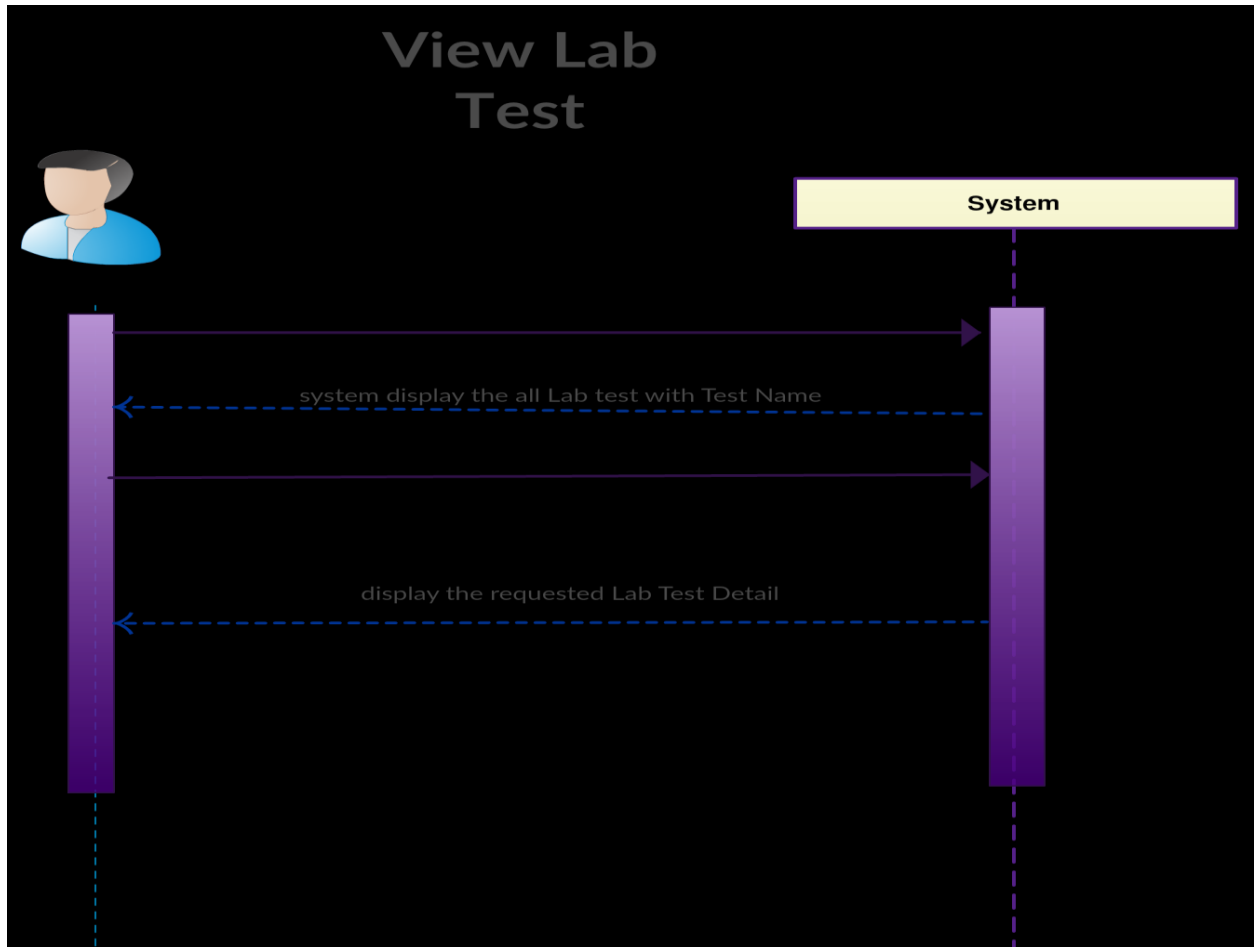


Figure 4-7

7. View Consultant's Profile

This is a case in which patients can view Consultants profile, Patient can view Consultant Profile forget basic information referred to his/her consultant such as consultant's Specialty, mobile numbers as show in (Figure 5-8).

Actor: Patient

Preconditions:

None

Postcondition: If the case successful, the patient able to view consultant profile successfully.

Main success scenario:

1. The Patient search the doctors by their Name as well as Specialty or patient select the option for view all patient.
2. System show available doctor regard to doctors' specialty (dentist, Cardiologist, Chiropractor, urologist, psychiatrist, Psychiatrist, Dermatologist).

3. The Patient select an option to view Consultant Profile.
4. System display Consultant profile

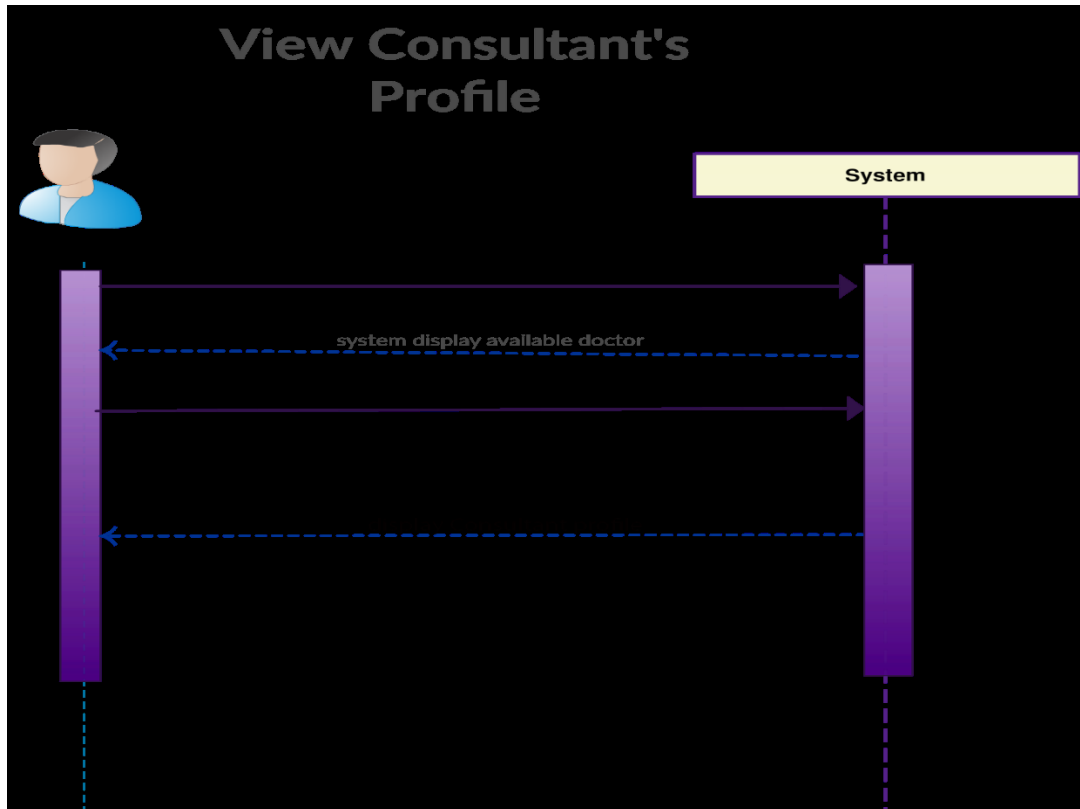


Figure 4-8

8. Make Appointments slots (Create Schedule)

This is a case in which a doctor can set Appointment slots to make sure his availability time in the clinic as show in (Figure 5-9).

Actor: Doctor,

Precondition: The doctor must already have a login to the system.

Postcondition: If the case successful run, then doctor's Schedule create successfully.

Basic Flow:

1. The doctor selects the option for creating a schedule.
2. The System display the schedule list for (5 minutes slots,10 minutes slots, 15 minutes slots, 15 25 minutes, 30 minutes)

3. The doctor select the desired option from schedule list (5 minutes slots, 10 minutes slots, 15 minutes slots, 25 minutes, 30 minutes) and submit his selected option.
4. The system display calendar regard to selected option (5 minutes slots, 10 minutes slots, 15 minutes slots, 25 minutes, 30 minutes)
5. The Doctor select the time (available time in hospitals or clinics) and click on submit record
6. System save the record and give alert message “Appointment schedule Create Successfully”.

Make Appointment slots (Create schedule)

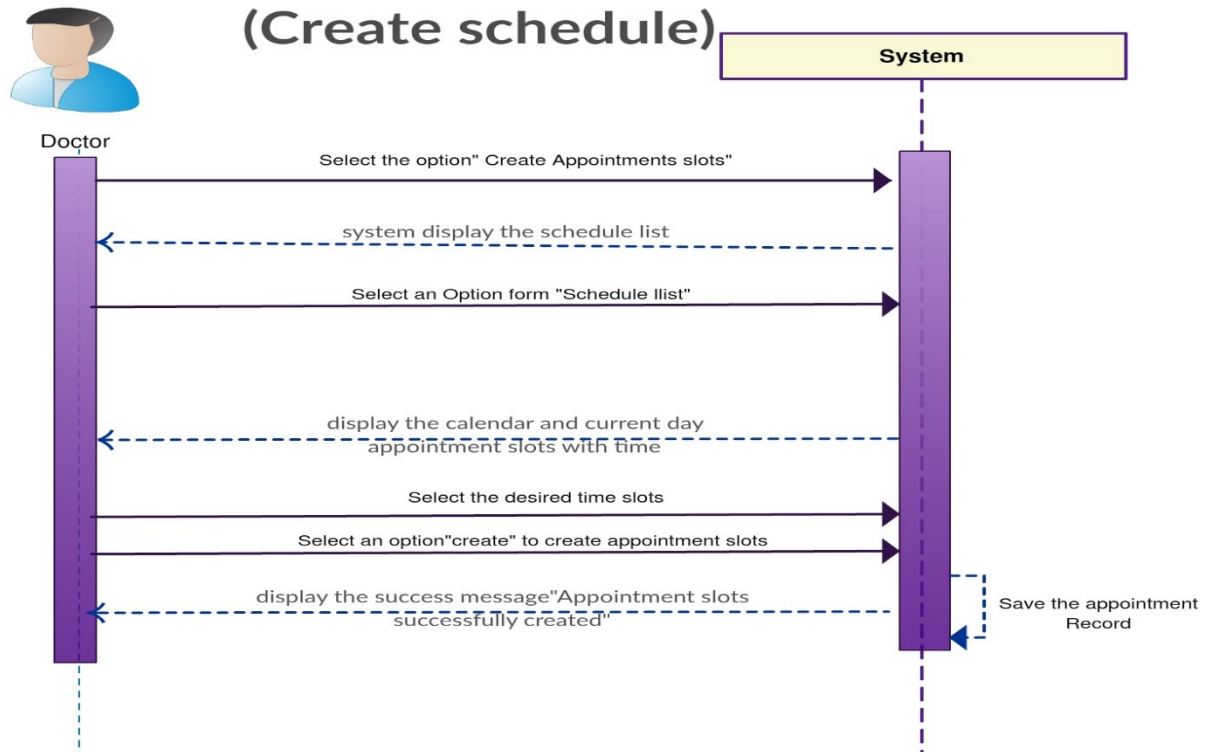


Figure 4-9

9. Prescribe to a patient

This is a case in which a doctor prescribed to the individual by using E-Health Management system. The case begins when a patient comes to doctor’s room and the doctor examines to the patient in case if the patient registers (a patient having a medical history in the hospital) patient’s history be helpful during the examination as show in (Figure 5-10).

Actor: Doctor, Patient:

Precondition:

- The doctor must already have a login to the system.
- The patient must already have confirmed appointment booking to the system.
- The system must have the ready-made prescription.

Postcondition: If the case was successful, the patients is now able to get his medication history from his account. And the system send him, his medication history from medication repository. If the case remains unsuccessful system state remain unchanged.

Main success scenario:

The following in main success scenario:

1. The doctor select option for prescribing to patient
2. Doctor search for the readymade prescription (Typhoid Fever, Food Poisoning, Diarrhea, Viral hepatitis, Tuberculosis, Cardiovascular, lung cancer, Diabetes).
3. The System display the prescription form having (Symptoms, Suggest medicine, and medicine frequency, suggest Test, Notes).
4. The doctor select the symptoms of searched ready made prescription.
5. The Doctor Select the option for save patient's Symptoms.
6. System save the patient Symptoms and give confirmation message "Record save Successfully"
7. The doctor select the medicine that he wants to medicate his patients.
8. The system adds the medicine in Prescription report list with parameters frequency dosage etc.
9. Doctor enter the frequency against tab or syrup i.e. (Once time in a day, two times in a day, Three times in a day) and select an option to submit records
10. System save the records and with alert message "Patient record save successfully"

Prescribe to a Patient

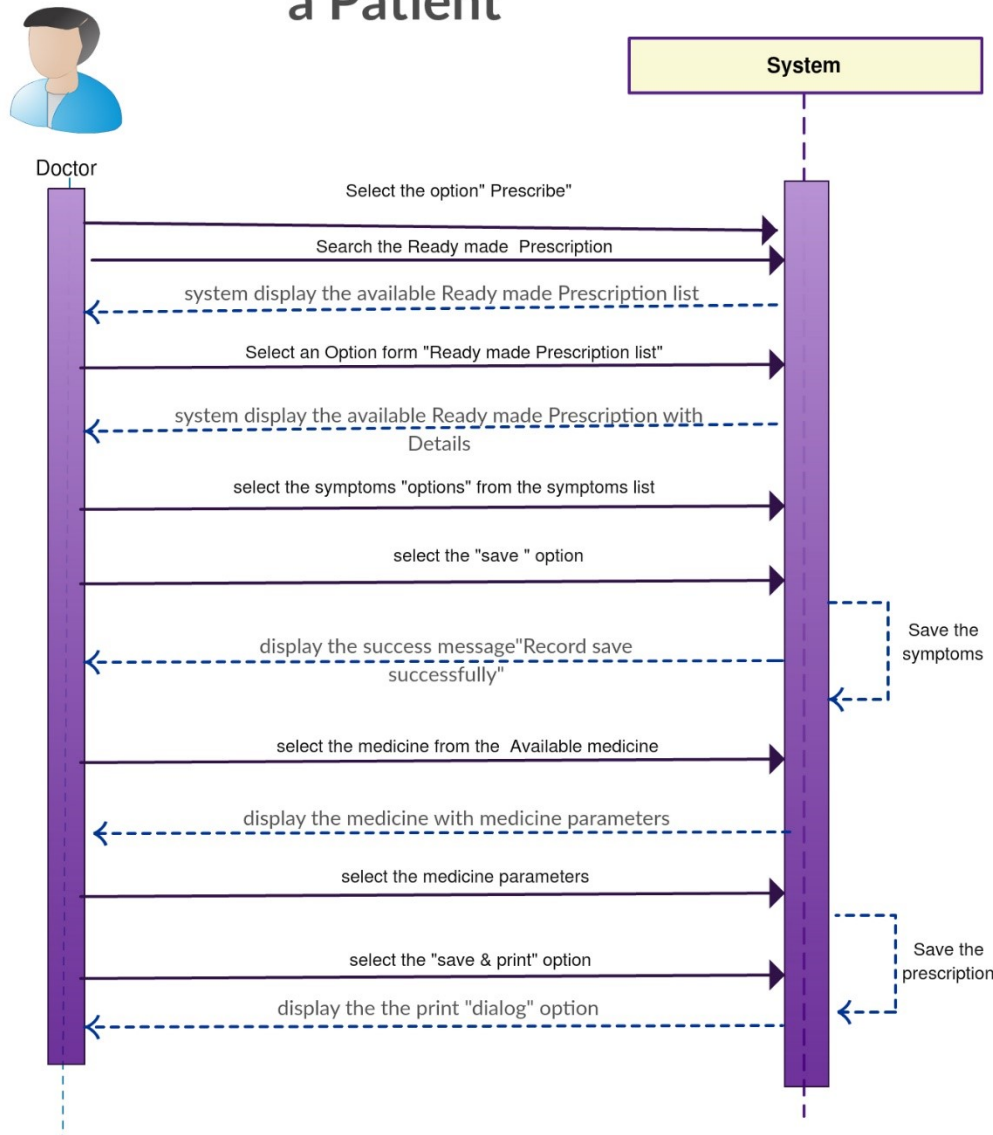


Figure 4-10

10. Suggest Medical Tests Test:

This case describes how a doctor can recommend tests to Patient as show in (Figure 5-11).

Precondition:

- 1 The doctor must be login into the system.
- 2 Doctor have one or more than appointment.

Postcondition: If case runs successfully, Doctor became able to recommend medical Test to his/her patient.

Basic Flow:

1. Doctor select an option to Recommend Lab test to his option
2. System Display All medical Test.
3. Doctor Select the test that he wants to recommend his patient and select an option to save the Pathology's test.
4. Doctor select an option to search the select's test Component.
5. The system displays the Component of medical test (Pathology's test Component).
6. Doctor select the Component (Pathology's test Component) and select on option to save the component
7. System save the record and display message "Record save successfully"

Suggest Lab Test

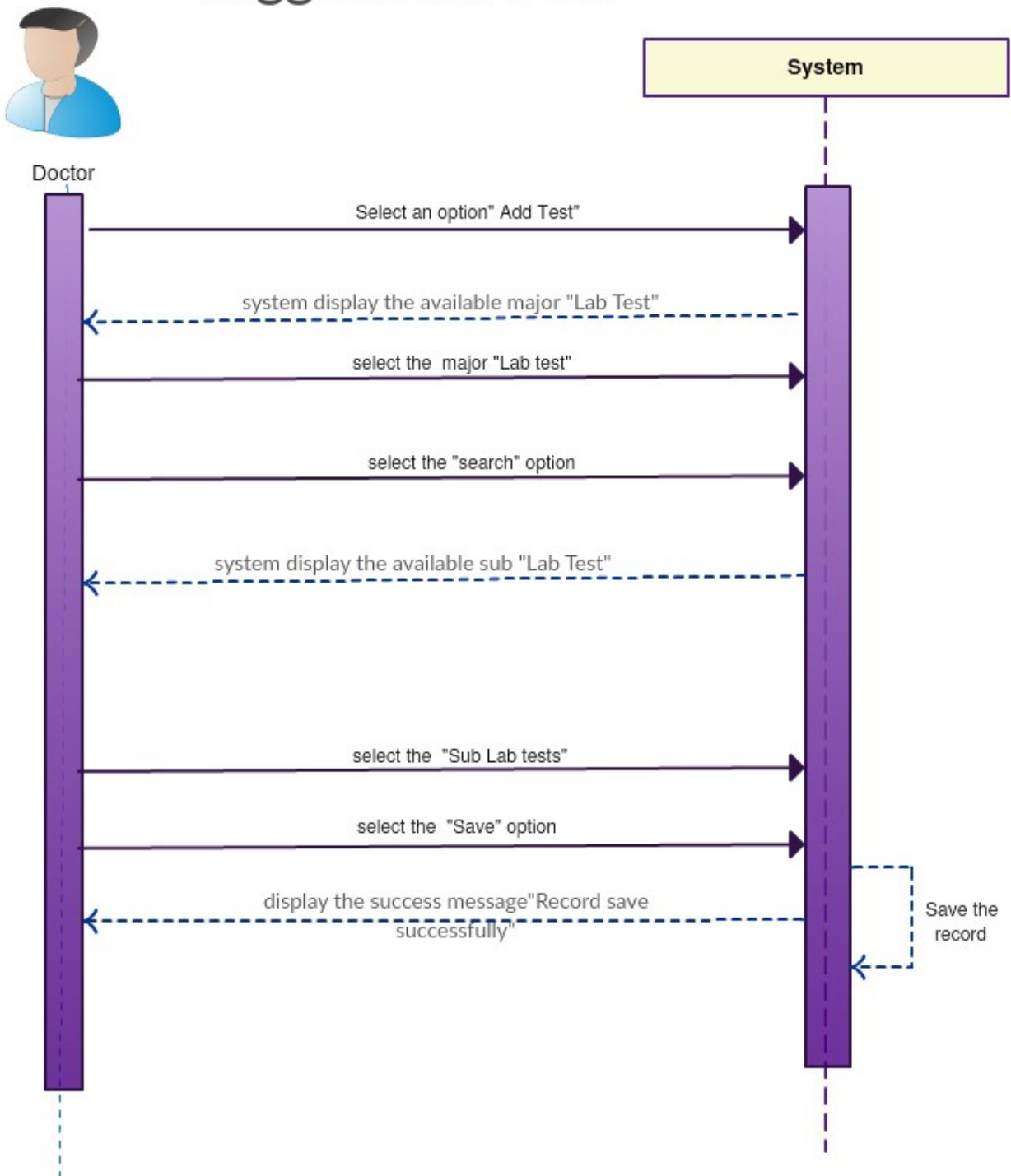


Figure 4-11

11. Review patient medical history (For doctors):

This case describes how a Doctor can view his/her patient medical history as show in (Figure 5-12).

Precondition:

- The doctor must be login and have access to patient history.
- Patient have appointment with doctors

Post-condition: if case successfully doctor should be able to review medical history

Basic Flow:

1. Actor selects an option for View patient to appoint appointments.
2. The system displays all appointments.
3. Doctor select an option to prescribe to a patient.
4. System display prescription page having basic patient info(patient name, medical record number)
5. Doctor select an option to view patient previous prescriptions.
6. System display all previous prescriptions
7. Doctor select an option to view detail of prescriptions.
8. System display prescription detail medicine name, patient Symptoms, patient medical Lab test, and patient X-ray.

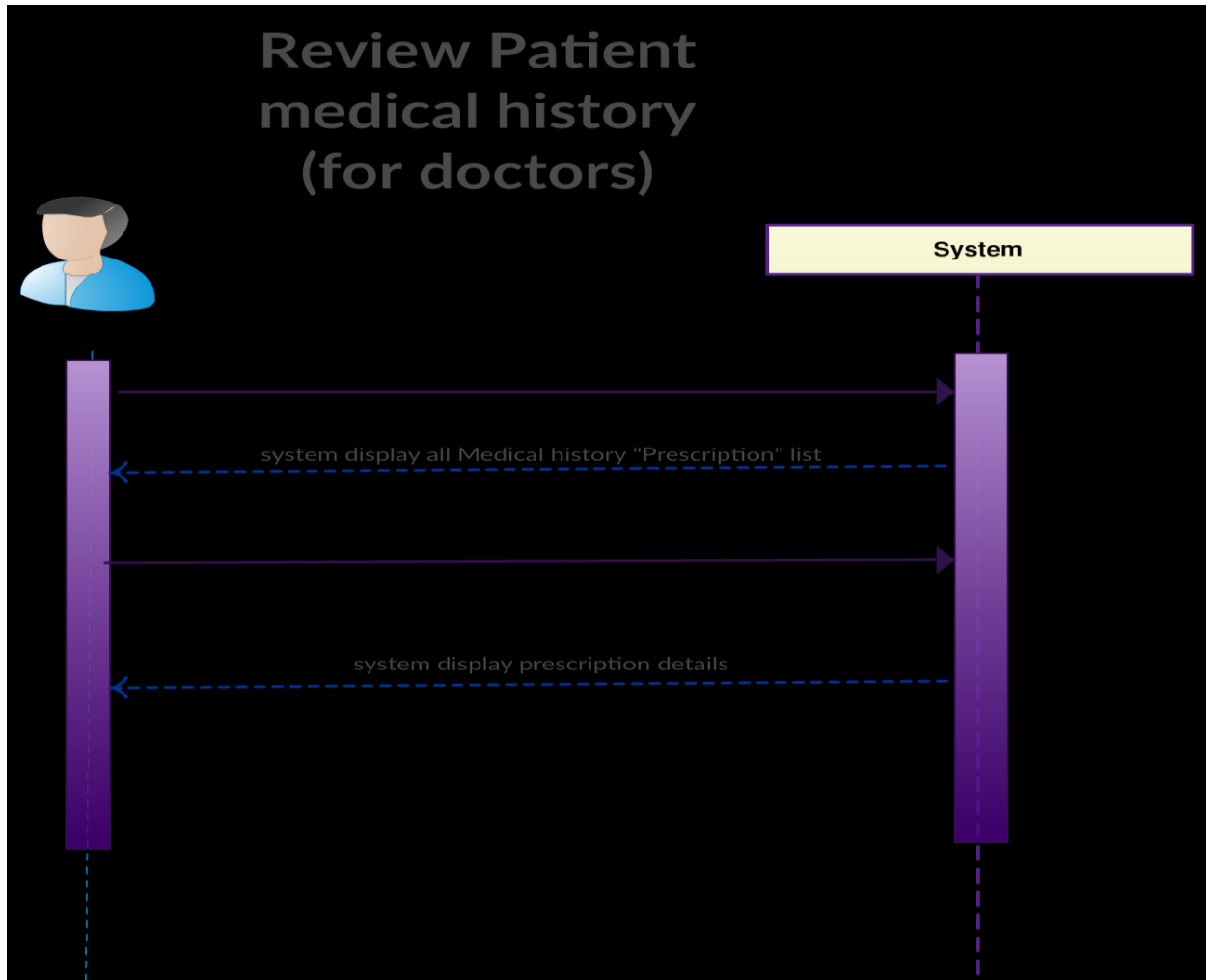


Figure 4-12

12. Register patient (by the receptionist):

This case describes how a Receptionist can register the walk-in patients (new patient that have no account in system) as show in (Figure 5-13).

Precondition:

Receptionist must be login.

Post Condition:

If case successfully run then Receptionist can be able to register new patient successfully

Basic Flow:

1. Receptionist selects the option for register patient.
2. The system displays patient registration page.
3. Receptionist enters the username and selects an option to register the patient.

4. The system generates the default password against the entered username.
5. The system saves the record and gives alert message “Record save successfully”.

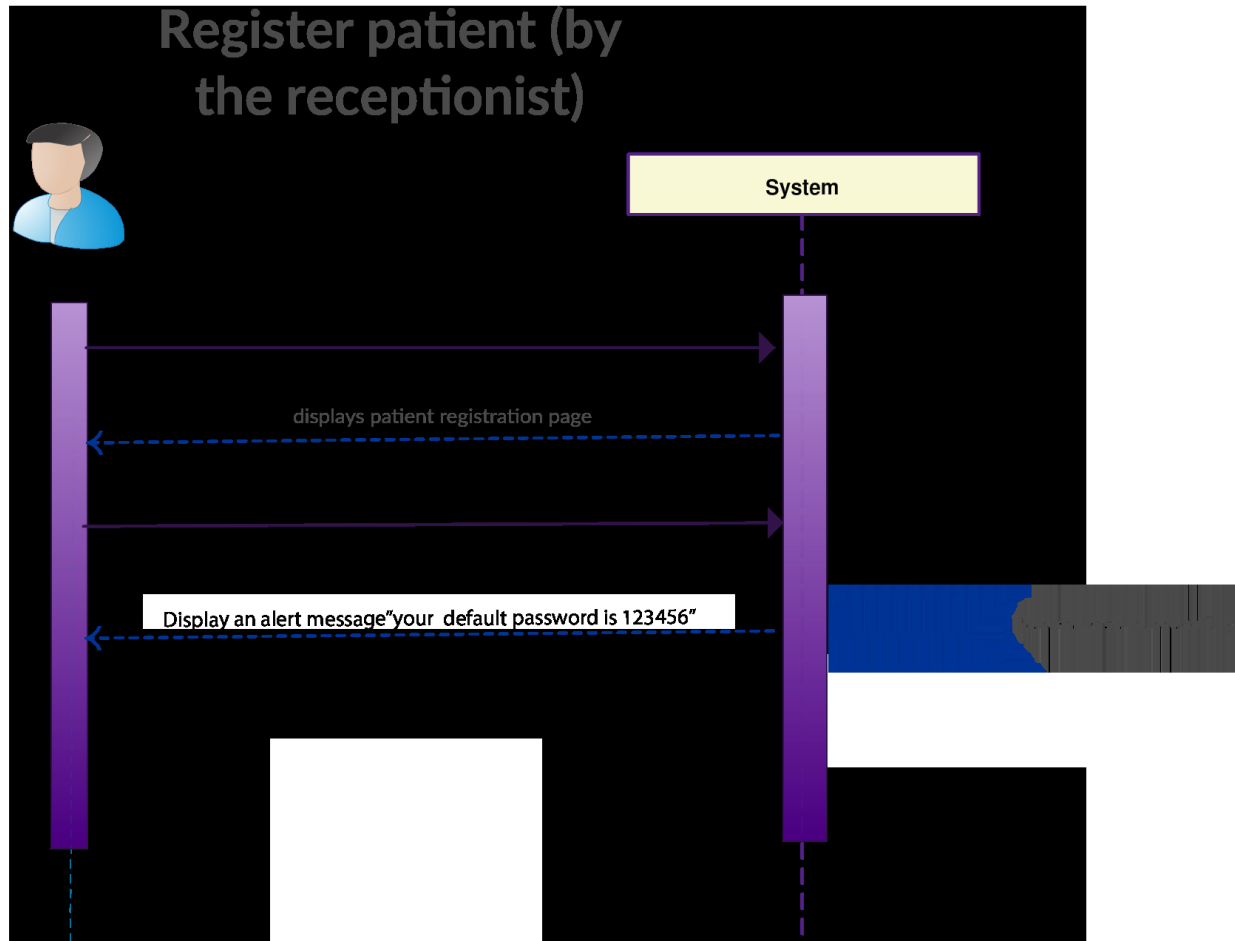


Figure 4-13

13. Add Patient’s Vital signs:

This case describes how a Nurse can add the patient vitals as show in (Figure 5-14).

Precondition:

The nurse must be login.

Post Condition:

If case successfully run then the Nurse can be able to add the patient vital signs.

Basic Flow:

1. Nurse select the option for Add patient vital signs.

2. System show all the patients that have booked appointment as well as confirm appointment by paying the Consultancy fee(Name, Contact number)
3. Nurse select an option for add patient vitals of particular patient (a patient that are present).
4. The system displays page for add patient vitals.
5. Nurse add the Patient General vitals (Heart rate, Plus BPM, Blood pressure, Respiration rate, Temperature) and select an option to save the patient's vitals.
6. System save the record by giving alert message "Record save successfully"

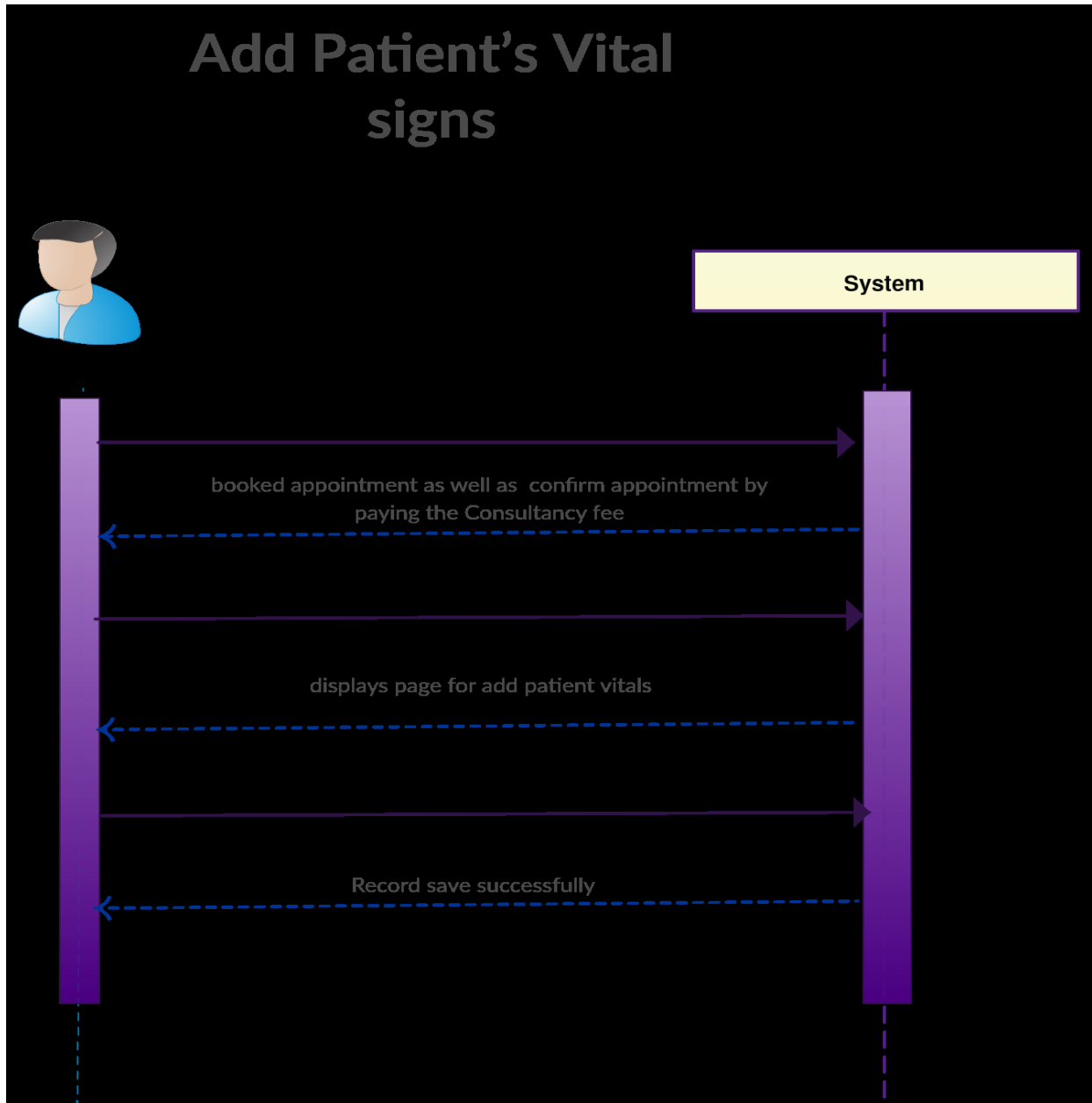


Figure 4-14

14. Update Patient's Vital signs:

This case describes how a Nurse can update the patient vitals nurses only updated the patient vitals of their department as show in (Figure 5-15).

Precondition:

The nurse must be login.

Post Condition:

If case successfully runs, then the Nurse can be able to update the patient vital signs.

Basic Flow:

1. Nurse select the option for Update patient vital signs.
2. System shows all the patients that have given already patient vitals.
3. Nurse select an option for an updated patient vitals.
4. The system displays page for update patient vitals.
5. Nurse Update the Patient General vitals (Heart rate, Plus BPM, Blood pressure, Respiration rate, Temperature) as well as Specialized vitals(height, weight, Metric BMI) and select an option to save the Updated patient's vitals.
6. System save the record by giving alert message "Record save successfully"

Alternate flow:

- 2.1 There is no patient that already give the patient vitals
 - .1.1 System show error message "No record found".

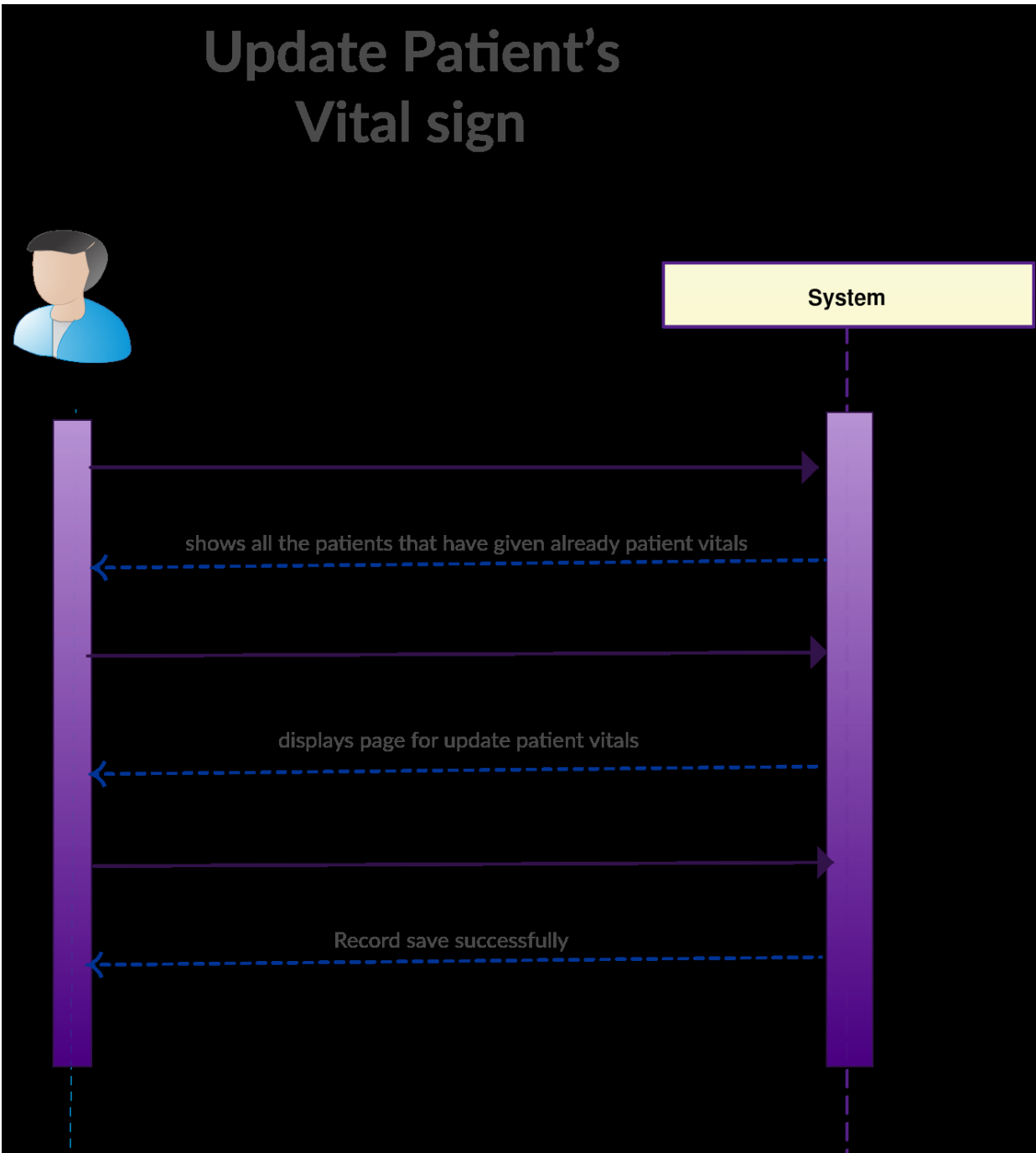


Figure 4-15

15. Add Staff (Doctors, Nurse, Phlebotomist, Receptionist)

This is a case describes how an Actor admin can add staff (doctor, Nurse, phlebotomist) into the System (E-health Management) as show in (Figure 5-16).

Precondition:

User (Admin) must be login.

Basic flow:

1. Admin select an option to add staff (doctor, Nurse, Phlebotomist, Receptionist) into E-Health Management
2. The system opens the page for add staff (doctor, Nurse, Phlebotomist, Receptionist).
3. Admin enter the User Name of Staff
4. Admin select an option to submit records

Alternate flow:

3. Admin enters the Username that already exists in System.
4. System display error message “Entered Username is already registered in the system”. Admin enters the Unique Username System proceed this step.



Figure 4-16

16. Update Staff's record (Doctors, Nurse, Phlebotomist, Receptionist)

This is a case that describes how an admin can update the Doctor's record into the E-health Management as show in (Figure 5-17).

Precondition: Admin user must be login.

Basic flow:

1. Admin select an option to View all active staff's records (Doctors, Nurse, Phlebotomist, Receptionist) into E-Health Managment
2. The system opens the page having all doctor records.
3. Admin Search the doctor for update the record.
4. Admin select an option to Update the records
5. System open the page for update records
6. Admin Update any fields (Qualification, Phone number, Gender, Email, Phone number, Address, Image) Admin select an option to save the updated Record.

Alternate flow:

1. There is no record of registered doctor
 - 1.1 System generate error message "No record found"
3. Admin enters the name that doesn't exist
5. System generate error message "record not found"

Update Staff's record (Doctors, Nurse, Phlebotomist, Receptionist)

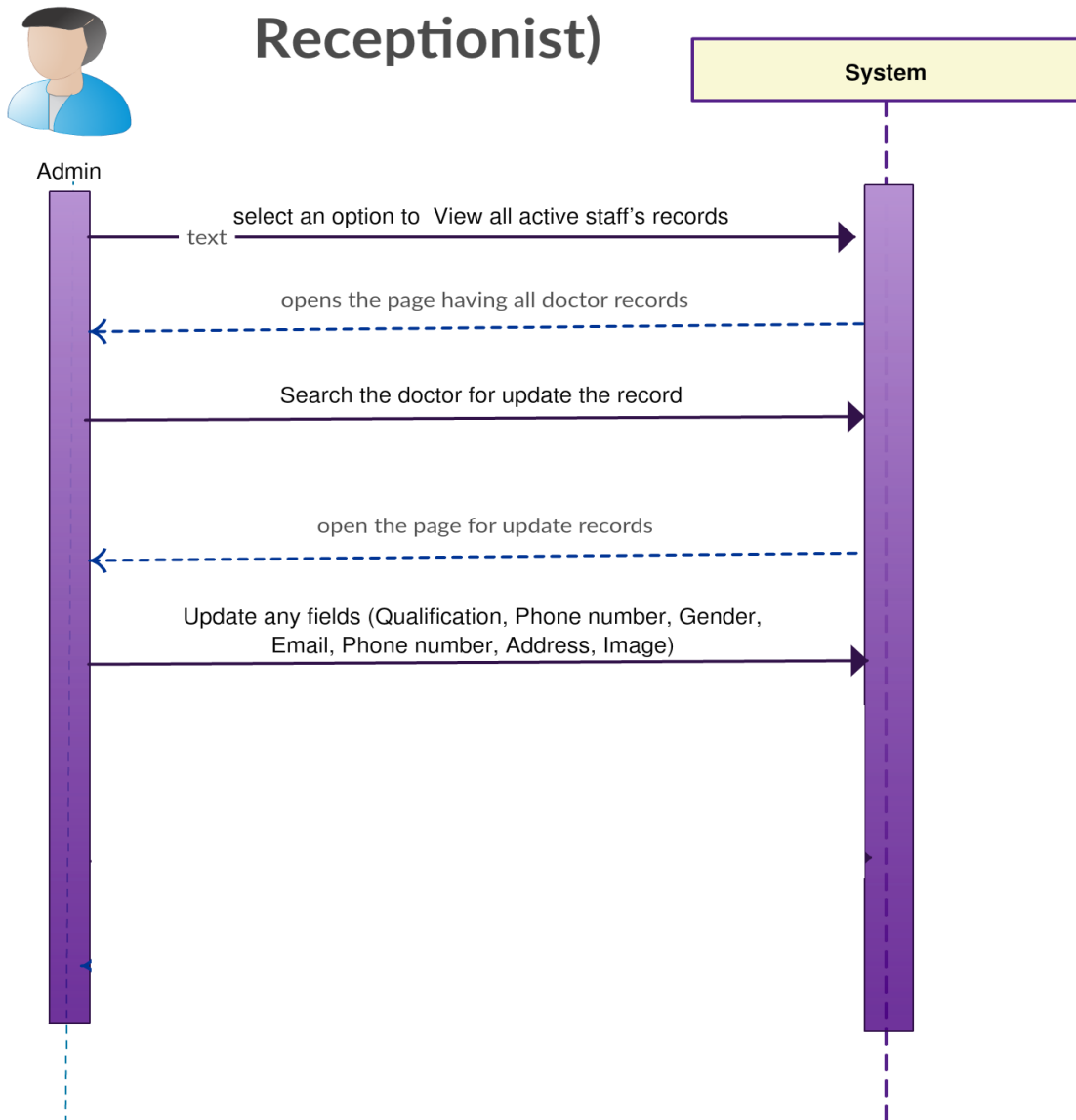


Figure 4-17

17. Search for specific disease (by student)

This is a case in which the student can search for specific diseases as show in (Figure 5-18).

Precondition:

The actor's student must be logged into the system.

Post condition:

Students searched for specific diseases successfully.

Basic Flow:

1. The student selects the "Search data for Epidemiology" option from his account.
2. The System display search field (search by Age, search by specific diseases search).
3. The student enter search criteria (search by Age, search by Specific disease).
4. The System display the searched record.

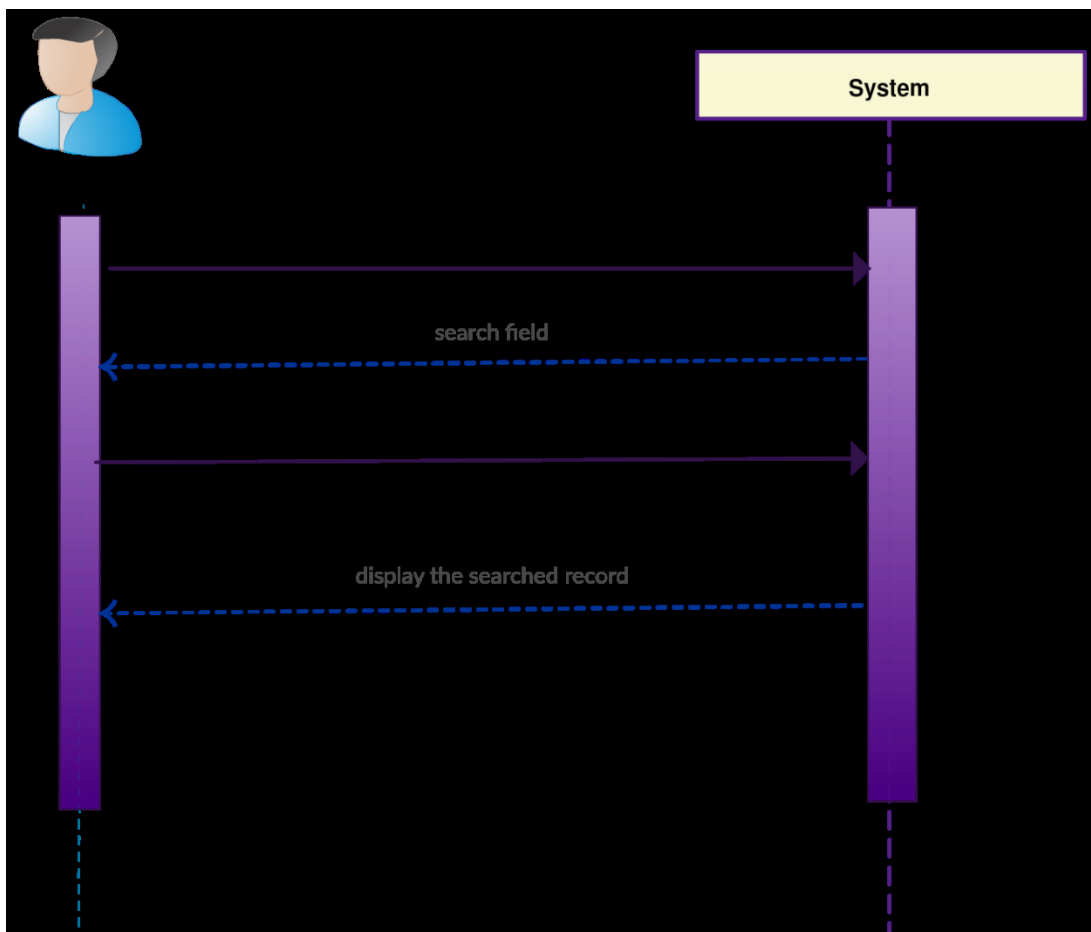


Figure 4-18

5 Chapter: System Design- Wire Frames

In this chapter, I will describe the process of defining and designing of the architecture and the interfaces for an E-Health Management System to satisfy specified requirements. I have used wireframe to show layout of a web page that demonstrates what interface elements will exist on key pages of E-Health Management System [15]. It is a critical part of the interaction design process. I have used Moqups.com website to generate wireframes [16]

This chapter has following outline:

- Class Diagram
- Dashboard Wireframe
- User Profile Wireframe
- Doctor Schedule
- Show Booked Appointments
- Prescribe to Patient
- Search Patient for Medical History
- View Patient Historical Prescriptions
- View Patient Historical Medical Tests

5.1 Class diagram

The Class diagram is a static diagram. It represents the static view of an application. Class diagram is not only used for visualizing, describing, and documenting different aspects of a system [17]. The following diagram (Figure 5-1) is E-HMS system class diagram. It can be clearly seen by zooming in this page.



Figure 5-1

5.2 Dashboard Wireframe

The following diagram (Figure 6-1) show the dashboard for all user after successfully login into system.



Figure 5-2

5.3 User Profile Wireframe:

The following diagram (Figure 6-2) show the user profile. This will have all details of user.



Figure 5-3

5.4 Doctor Schedule:

The following diagrams will show the process for doctor to create their available schedule.

Selection of Date:

In the following diagram (Figure 6-3) shows the web page where doctor has to select particular date to create a schedule for his availability.



Figure 5-4

Save Availability Slots:

In the following diagram (Figure 6-4) shows the web page where doctor will be shown all the possible slots which he has to select to create schedule according his availability.



Figure 5-5

5.5 Show Booked Appointments:

In the following diagram (Figure 6-5) shows the web page where doctor has to select today date to check all the booked appointments by patients. Then this web page will show all booked appointments



Figure 5-6

5.6 Prescribe to Patient:

In the following diagram (Figure 6-6) shows the web page where doctor will prescribe to patients.



Figure 5-7

5.7 Search Patient for Medical History:

In the following diagram (Figure 6-7) shows the web page where doctor will be able to search patient medical history.



The screenshot shows a web interface for the E-Health Management System. At the top, there is a header bar with the system logo on the left, the text "E-Health Management System" in the center, and "Main" and "Logout" buttons on the right. Below the header is a search form titled "Serach Patient Medical History". The form contains three input fields: "Name", "OR", and "Id", followed by a "Search" button.

Figure 5-8

In the following diagram (Figure 6-8) shows the web page which will show list of all patient.

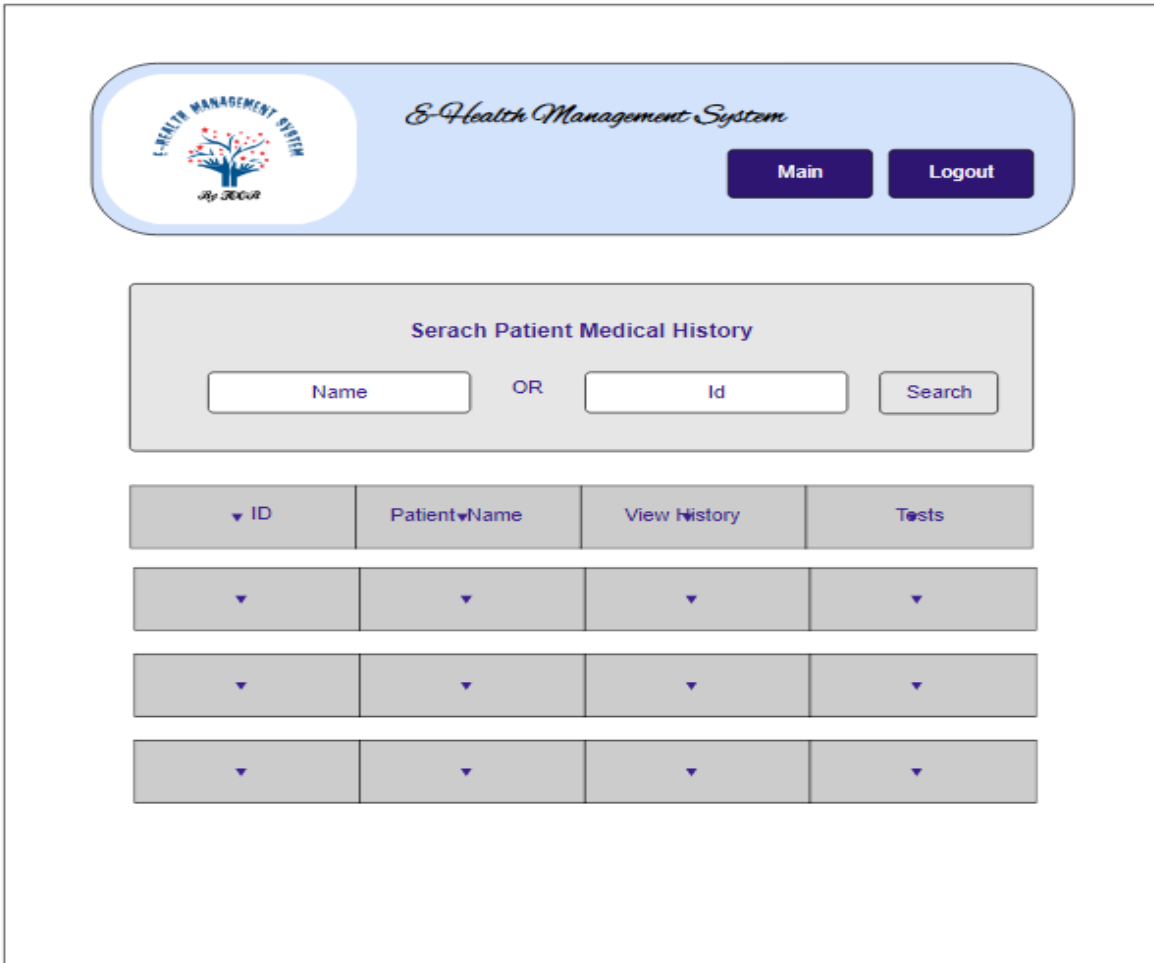


Figure 5-9

5.8 View Patient Historical Prescriptions:

In the following diagram (Figure 6-9) shows the web page which will show whole list of previous medical tests of particular selected patient.

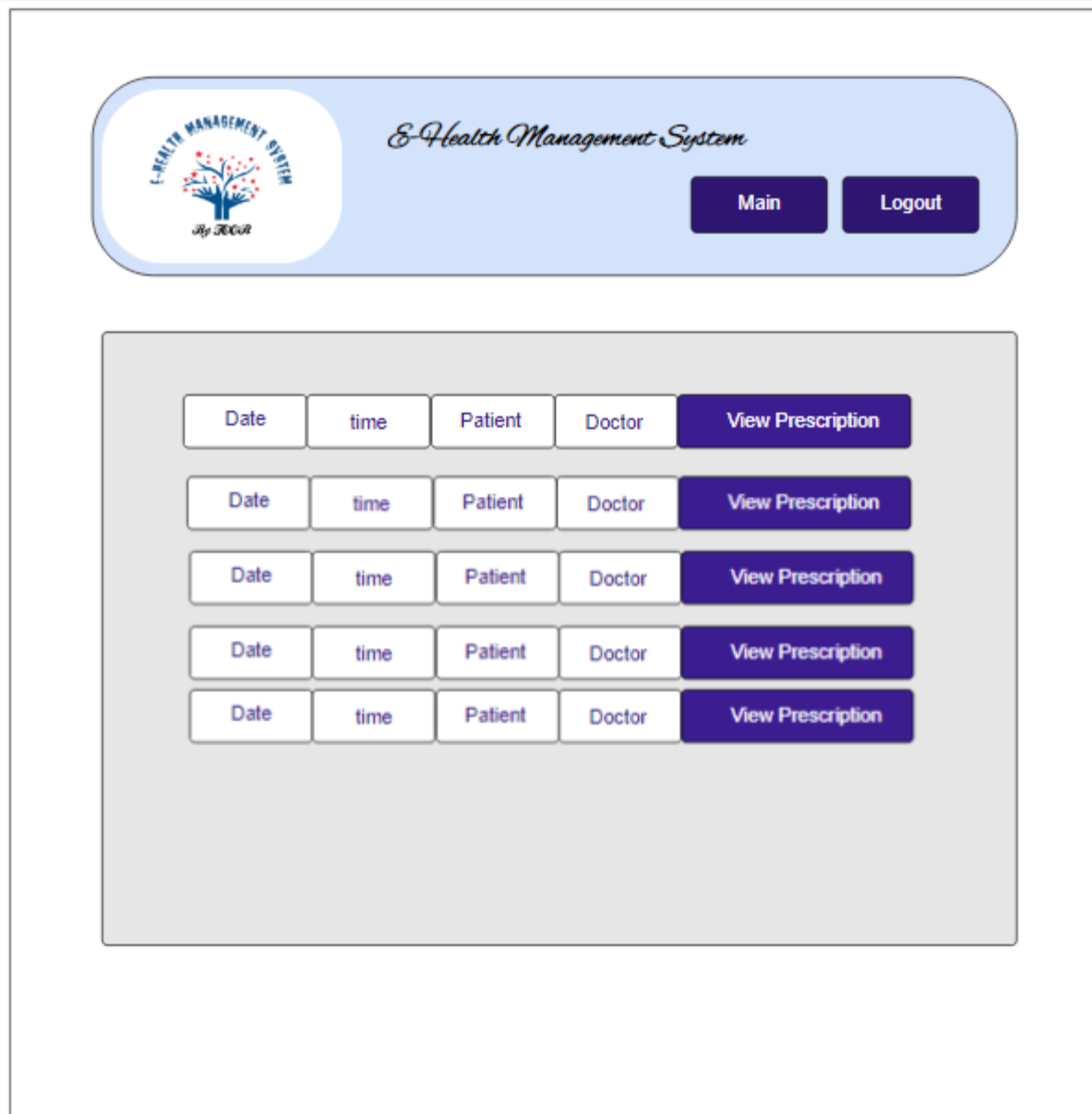


Figure 5-10

5.9 View Patient Historical Medical Tests:

In the following diagram (Figure 6-10) shows the web page which will show whole list of previous medical tests of particular selected patient.

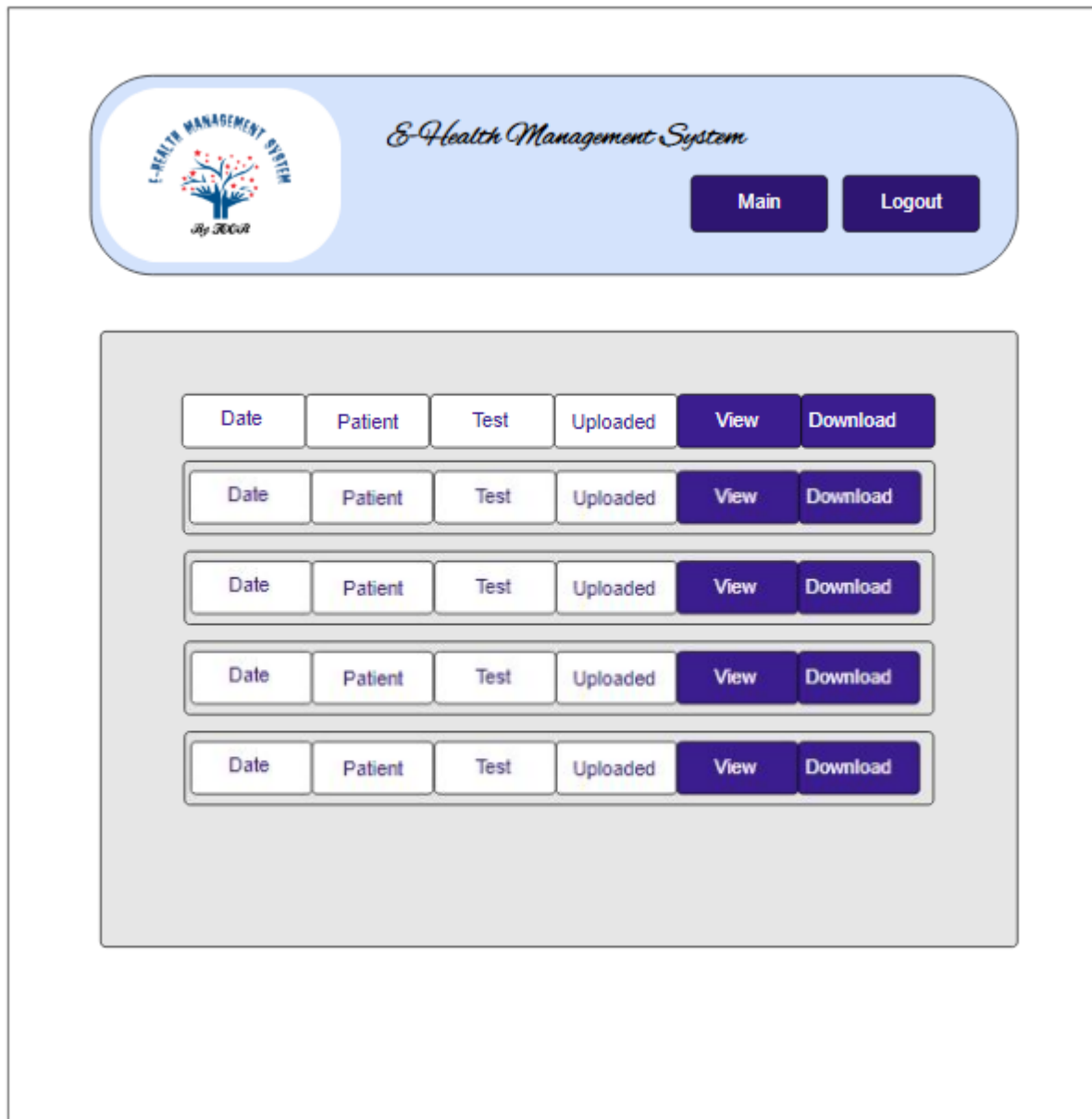


Figure 5-11

5.10 Database design:

The following figure (Figure 5-12 and 5-13) shows the database.

Table	Action	Rows	Type	Collation	Size	Overhead
appointments	★ Browse Structure Search Insert Empty Drop	24	InnoDB	latin1_swedish_ci	16 Kib	-
createdbookedappointments	★ Browse Structure Search Insert Empty Drop	58	InnoDB	latin1_swedish_ci	32 Kib	-
patientmedicine	★ Browse Structure Search Insert Empty Drop	11	InnoDB	latin1_swedish_ci	16 Kib	-
patientnote	★ Browse Structure Search Insert Empty Drop	5	InnoDB	latin1_swedish_ci	16 Kib	-
patientsymptom	★ Browse Structure Search Insert Empty Drop	9	InnoDB	latin1_swedish_ci	16 Kib	-
patienttest	★ Browse Structure Search Insert Empty Drop	15	InnoDB	latin1_swedish_ci	16 Kib	-
tests	★ Browse Structure Search Insert Empty Drop	3	InnoDB	latin1_swedish_ci	16 Kib	-
user	★ Browse Structure Search Insert Empty Drop	13	InnoDB	latin1_swedish_ci	16 Kib	-
8 tables	Sum	138	InnoDB	latin1_swedish_ci	144 Kib	0 B

Figure 5-12

hms appointments Id : int(100) slot : varchar(100)	hms tests Id : int(200) Title : varchar(200) Lab : varchar(200)	hms createdbookedappointments Id : int(100) slotdate : varchar(100) slottime : varchar(100) doctorid : int(100) patientid : int(100)	
hms user UserId : int(100) UserName : varchar(100) UserGender : varchar(100) UserEmail : varchar(100) UserPassword : varchar(100) UserNumber : int(100) UserDiscription : varchar(100) UserAddress : varchar(100) UserType : varchar(100) UserImage : varchar(100) UserStatus : varchar(100)	hms patienttest Id : int(250) patientid : int(250) doctorid : int(250) test : varchar(250) phlebotomistid : varchar(250) date : date completeddate : date bill : varchar(200) report : varchar(500)	hms patientnote Id : int(200) patientid : int(200) doctorid : int(200) date : varchar(200) notes : varchar(200)	hms patientsymptom Id : int(200) patientid : int(200) doctorid : int(200) date : varchar(200) symptoms : varchar(200)
	hms patientmedicine Id : int(200) patientid : int(200) doctorid : int(200) medicine : varchar(200) frequency : varchar(200) duration : date date : date		

Figure 5-13

6 Chapter: Technologies


In this chapter, I will describe all technologies used to develop E-Health Management System and the justifications why I selected those technologies.

The following is outline for this chapter:


- **Front End:** HTML, CSS, JAVASCRIPT, JQUERY AJAX
- **Back End:** PHP
- **Database:** MYSQL
- **SERVER:** XAMP

6.1 Front End:


The front end of a website is the part a user sees and directly interacts with their web browsers. There are following programming languages which I have used to develop front end of my E-Health Management System.

HTML  Hypertext Markup Language (HTML) provides the behind-the-scenes formatting and layout information for web pages. In much the same way as the behind-the-scenes formatting of a Word document tells Microsoft Word how to display that document, HTML tells the web browser how to display a web page. HTML marks up, or adds hidden information to, the text and other things that you put on a web page [18].

Reason: I have used HTML to build the frontend of my E-HMS system as it takes care of all the structure and content of my application. It helps in providing elements and content a set of logic and instructions on how they must appear on a web page browser

CSS  CSS complements HTML by providing a look and feel to web pages. The HTML pages you created in the preceding chapter looked fairly plain, with a default font and font size. Using CSS, you can spice up that look, adding color and background images, changing fonts and font sizes, drawing borders around areas, and even changing the layout of the page itself [18].

Reason: I have used CSS to control the layout and format of Html web pages. CSS sets the colors, fonts, background images, and even the way of my web pages are laid out.

JS  JavaScript is used for web programming to enhance or add to the user experience when using a web page. This section looks at some of the aspects of JavaScript that will help you understand the language and give you a good foundation upon which you'll be able to really make your web pages stand out [18].

JavaScript provides the behavior or actions behind the interactivity on web pages.

Reason: I have used JavaScript as it helps to make E-HMS web pages dynamic and interactive by implementing custom client-side scripts. JavaScript let me to add in interactivity, more complex animations, and even makes my EHMS to be fully featured web application.



JQuery is a JavaScript library. A JavaScript library is a collection of code that you use when you want to get access to additional functionality or make life easier. JQuery does both. JQuery is quite popular. Although there are no accurate statistics to show how often JQuery is used, cursory glances at popular sites show that JQuery is all over the web. JQuery also makes cross-browser development easier [18].

Reason: I have used JQuery as it is a fast and concise JavaScript Library that simplifies HTML document traversing, event handling and animation.



AJAX is an acronym that stands for Asynchronous JavaScript and XML, and it describes a set of development techniques used for building websites and web applications. According to web developer and Skill crush Word Press instructor Ann Cascarano, the best way to understand AJAX is to start with identifying its specific purpose in the web development process. AJAX's core function is to update web content asynchronously (the "A" of AJAX), meaning a user's web browser doesn't need to reload an entire web page when only a small portion of content on the page needs to change [18].

Reason: I have used Ajax in my E-HMS as it allows web pages to be updated asynchronously by exchanging small amounts of data with the server behind the scenes. This means that it is possible to update parts of a web page, without reloading the whole page

6.2 Back End:

Back end is the "under the hood" parts of websites that users don't interact with them directly. I have used Php to build backend of my E-Health Management System.



PHP is a scripting language designed specifically for use on the web. It has features to aid you in programming the tasks needed to develop dynamic web applications. The PHP software works with the web server, which is the software that delivers web pages to the world. When you type a URL into your web browser's address bar, you're sending a message to the web server at that URL, asking it to send you an HTML file. The web server responds by sending the requested file. Your browser reads the HTML file and displays the web page [18].

Reason: I used Php to build back end of my web system to interact with database. It is a free language with no licensing fees so the cost of using it is minimal. A good reason of using PHP is that it can interact with many different database languages including MySQL. PHP can also run on Windows, Linux and UNIX servers.

6.3 MYSQL:

I have used MySQL database for my E-Health Management System.



Many dynamic websites require a backend database. The database can contain information that the web pages display to the user, or the purpose of the database might be to store information provided by the user. In some applications, the database both provides available information and stores new information. MySQL, the most popular database for use in websites, was developed to be fast and small, specifically for websites. MySQL is particularly popular for use with websites that are written in PHP, and PHP and MySQL work well together [18].

Reason: I have used MySQL database as it is a freely available open source Relational Database Management System (RDBMS) that uses Structured Query Language (SQL).

6.4 WEB SERVER: XAMPP

I have used XAMP as web server to run and test during developing E-HMS.



XAMPP is a popular all-in-one installation kit that contains Apache, PHP, and MySQL. XAMPP is available at www.apachefriends.org/en/xampp. Html Instructions for installing your software using XAMPP are provided in. XAMP in stack which lets you install Apache, MySQL and PHP in your computer together with some other useful software. It has been designed to provide you an easy installation experience. It's free and available for Windows, Mac OS and Linux [19].

Once XAMPP is installed on your local computer it acts as a local server or local host.

Reason: I used XAMP as it provides the suitable environment to test and run the web application before uploading it to the remote web server.

7 Chapter: Implementation

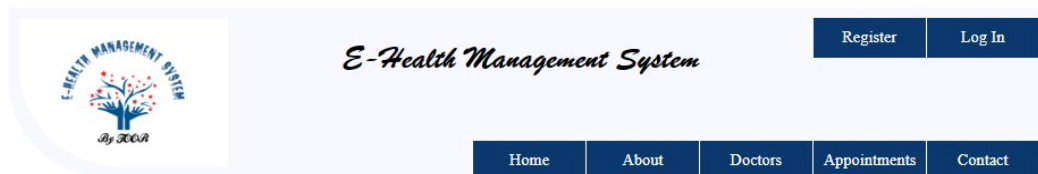
In this chapter, we will describe the implementation of E-Health Management System. This phase will reveal the process of coding and actual production of E-Health Management System.

This chapter has following outline:

- Index Page GUI
- Registration Page
- Log In Page
- Doctor Panel

7.1 Index Page GUI:

The following images (Figure 7-1, Figure 7-2) is the index page of my E-Health Management System.



About E-Health

we aim to provide excellence in medical care to all our patients. We are dedicated to listening to you, discussing your mental and physical concerns in an honest and open fashion. We will provide you with up to date, evidence-based medical advice to make informed choices when it comes to managing your health.

Figure 7-1

Continue Index Page:

Doctors

We aim to provide excellence in medical care to all our patients. We are dedicated to listening to you, discussing your mental and physical concerns in an honest and open fashion. We will provide you with up to date, evidence-based medical advice to make informed choices when it comes to managing your health.



Appointment

We aim to provide excellence in medical care to all our patients. We are dedicated to listening to you, discussing your mental and physical concerns in an honest and open fashion. We will provide you with up to date, evidence-based medical advice to make informed choices when it comes to managing your health.

Continue Index page:



Blood Test

We aim to provide excellence in medical care to all our patients. We are dedicated to listening to you, discussing your mental and physical concerns in good fashion.



Xray

We aim to provide excellence in medical care to all our patients. We are dedicated to listening to you, discussing your mental and physical concerns in good fashion.



Surgery

We aim to provide excellence in medical care to all our patients. We are dedicated to listening to you, discussing your mental and physical concerns in good fashion.



Book Appointment

We aim to provide excellence in medical care to all our patients. We are dedicated to listening to you, discussing your mental and physical concerns in good fashion.

Home	Home	Contact Details
About	About	E-Health Management System
Doctors	Doctors	Ph: +353 899659857
Appointments	Appointments	Email: toorhussain@gmail.com
Contact	Contact	Address: Dublin, Ireland.

Figure 7-2

7.2 Registration Page:

The following image (Figure 7-3) is the Registration page of my E-Health Management System Which user can use to get them registered with E-Health Management System as patient.



Figure 7-3

7.3 Log In Page:

The following image (Figure 7-4) is the log In page of my E-Health Management System.

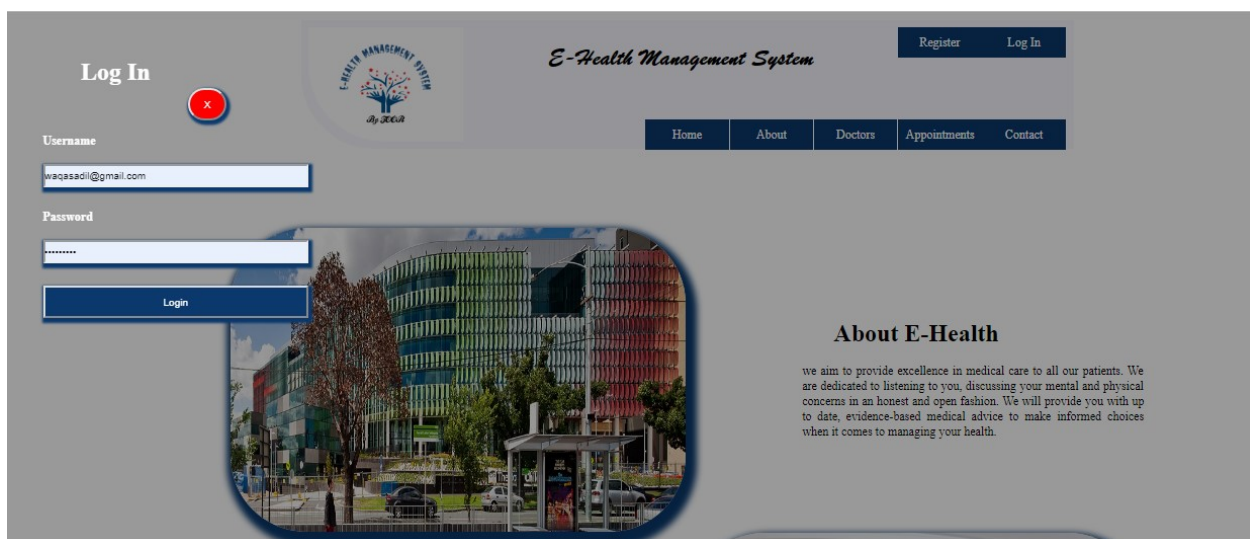


Figure 7-4

7.4 Doctor Panel:

The following image (Figure 7-5) is the doctor panel of my E-Health Management System.



Figure 7-5

The following image (Figure 7-6) shows the profile of doctor. In this page, doctor can change his profile picture and details.



Figure 7-6

The following image (Figure 7-7) shows the web page where doctor has to select particular date to create a schedule for his availability.

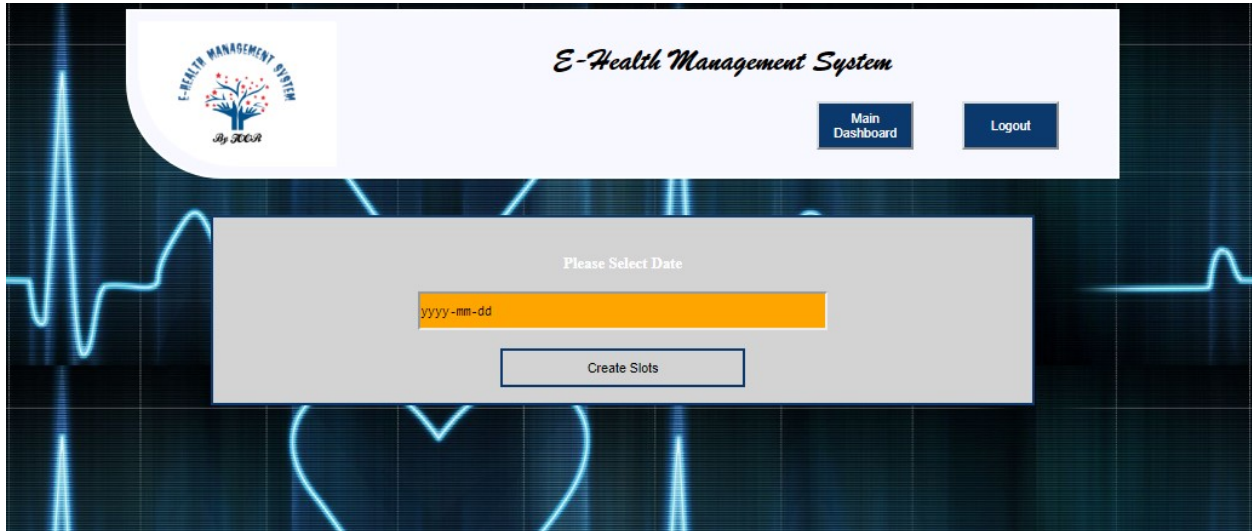


Figure 7-7

In the following diagram (Figure 7-8) shows the web page where doctor will be shown all the possible slots which he has to select to create schedule according his availability.



Figure 7-8

In the following diagram (Figure 7-9) shows the web page where doctor has to select today date to check all the booked appointments by patients. Then this web page will show all booked appointments



Figure 7-9

In the following diagram (Figure 7-10) shows the web page where doctor will prescribe to patients.

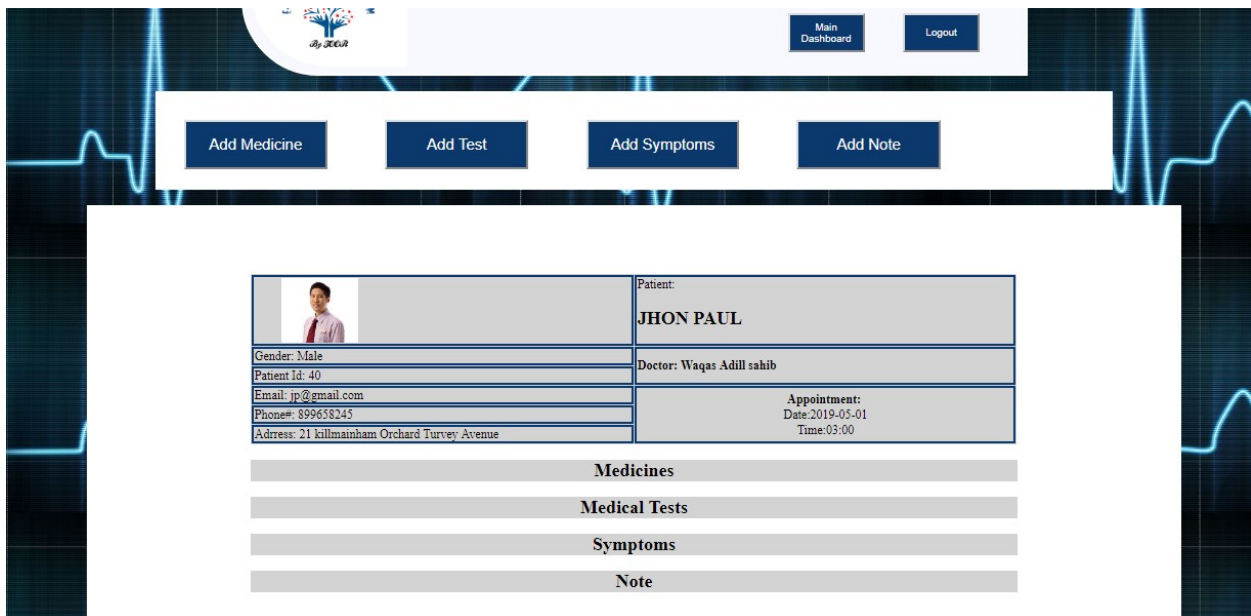


Figure 7-10

Note:

- **Complete Code is available on Github;**
<https://github.com/HusnainAToor/E-Health-Management-System>

- **Complete Demo is available on youtube:**
https://www.youtube.com/watch?v=5U1Z6_rjtpg&feature=youtu.be

8 Chapter: Software Testing

Software testing is the process of evaluation a software item to detect differences between given input and expected output. Also to assess the feature of a software item. Testing assesses the quality of the product. Software testing is a process that should be done during the development process. In other words software testing is a verification and validation process.

8.1 Verification

Verification is the process to make sure the product satisfies the conditions imposed at the start of the development phase. In other words, to make sure the product behaves the way we want it to.

8.2 Validation

Validation is the process to make sure the product satisfies the specified requirements at the end of the development phase. In other words, to make sure the product is built as per customer requirements.

8.3 Purpose of testing

There are two fundamental purposes of testing: verifying procurement specifications and managing risk. First, testing is about verifying that what was specified is what was delivered: it verifies that the product (system) meets the functional, performance, design, and implementation requirements identified in the procurement specifications. Second, testing is about managing risk for both the acquiring agency and the system's vendor/developer/integrator. The testing program is used to identify when the work has been "completed" so that the contract can be closed, the vendor paid, and the system shifted by the agency into the warranty and maintenance phase of the project.

8.4 Methods used to conduct testing

There are five basic verification methods, as outlined below.

- **Inspection** - Inspection is the verification by physical and visual examinations of the item, reviewing descriptive documentation, and comparing the appropriate characteristics with all the referenced standards to determine compliance with the requirements.
- **Certificate of Compliance** - A Certificate of Compliance is a means of verifying compliance for items that are standard products. Signed certificates from vendors state that the purchased items meet procurement specifications, standards, and other requirements as defined in the purchase order. Records of tests performed to verify specifications are retained by the vendor as evidence that the requirements were met and are made available by the vendor for purchaser review.
- **Analysis** - Analysis is the verification by evaluation or simulation using mathematical representations, charts, graphs, circuit diagrams, calculation, or data reduction. This includes analysis of algorithms independent of computer implementation, analytical conclusions drawn from test data, and extension of test-produced data to untested conditions.

- **Demonstration** - Demonstration is the functional verification that a specification requirement is met by observing the qualitative results of an operation or exercise performed under specific condition. This includes content and accuracy of displays, comparison of system outputs with independently derived test cases, and system recovery from induced failure conditions.
- **Test (Formal)** - Formal testing is the verification that a specification requirement has been met by measuring, recording, or evaluating qualitative and quantitative data obtained during controlled exercises under all appropriate conditions using real and/or simulated stimulus. This includes verification of system performance, system functionality, and correct data distribution.

8.5 Manual testing

Manual testing is the process of manually testing software for defects. It requires a tester to play the role of an end user, and use most of all features of the application to ensure correct behavior. To ensure completeness of testing, the tester often follows a written test plan that leads them through a set of important test cases.

A key step in the process of software engineering is testing the software for correct behavior prior to release to end users.

For small scale engineering efforts (including prototypes), exploratory testing may be sufficient. With this informal approach, the tester does not follow any rigorous testing procedure, but rather explores the user interface of the application using as many of its features as possible, using information gained in prior tests to intuitively derive additional tests. The success of exploratory manual testing relies heavily on the domain expertise of the tester, because a lack of knowledge will lead to incompleteness in testing. One of the key advantages of an informal approach is to gain an intuitive insight to how it feels to use the application.

Log In Test Case:

The following figure (Figure 8-1) is manual test case for Log in page testing.

Test Case Id	Objective	Pre-Condition	Steps	Description	Test Data	Expected Result	Actual Result
1	Verify the login functionality with username and password	Login page should be available	Step-1	Enter Valid URL in browser		Login Page should be displayed	Login page displayed
			Step-2	Enter valid user name in text box (Email)	User Name (Email)	Entered user name should be displayed	Entered user name is displayed
			Step-3	Enter valid password in text box	Password	Encrypted password should be displayed	Entered encrypted password is displayed
			Step-4	Click on Login button		User should be login successfully	User logged in successfully

Figure 8-1

Registration Form Test Case:

The following figure (Figure 8-2) is manual test case for user (Patient) registration form testing.

Test Case Id	Objective	Pre-Condition	Steps	Description	Test Data	Expected Result	Actual Result
1	Verify the Patient Registration functionality	Registration page should be available	Step-1	Enter Valid URL in browser		Registration Page should be displayed	Registration page displayed
			Step-2	Enter name in text box	User Name	Entered name should be displayed	Entered name is displayed
			Step-3	Enter valid contact number	Contact number	Encrypted password should be displayed	Entered encrypted password is displayed
			Step-4	Enter valid Email address	Email	Entered email should be displayed	Entered email is displayed
			Step-5	Enter Password	password	Encrypted password should be displayed	Entered encrypted password is displayed
			Step-6	Click Register button		User (patient) should be successfully registered	User (patient) is successfully registered

Figure 8-2

8.6 Automated testing

An automated software testing tool is able to playback pre-recorded and predefined actions compare the results to the expected behavior and report the success or failure of these manual tests to a test engineer. Once automated tests are created they can easily be repeated and they can be extended to perform tasks impossible with manual testing. Because of this, savvy managers have found that automated software testing is an essential component of successful development projects.

Automated software testing has long been considered critical for big software development organizations but is often thought to be too expensive or difficult for smaller companies to implement.

Automated software testing can increase the depth and scope of tests to help improve software quality. Lengthy tests that are often avoided during manual testing can be run unattended. They can even be run on multiple computers with different configurations. Automated software testing can look inside an application and see memory contents, data tables, file contents, and internal program states to determine if the product is behaving as expected [20].

Conclusion

It has been concluded that cloud based web application of E-HMS system will provide comprehensive, effective and efficient solution for carrying out management of hospitals and clinics fulfilling the needs and requirements of all stakeholders such as doctors, patients and staffs. This system has eighty percent been implemented. It has also future scope and more features will be added with time.

Appendix: A Code Sample

Index Page Code:

```

1 <html>
2 <head>
3     <link rel="stylesheet" type="text/css" href="index.css">
4     <link rel="stylesheet" type="text/css" href="indexbody.css">
5     <script src="index.js"></script>
6     <title>HMS</title>
7 </head>
8 <center>
9
10 <body>
11 <header>
12     <div id="header-div1">
13         
14         <div id="header-menu1">
15             <ul id="menu-ul">
16                 <li onclick="
17                     document.getElementById('login').style.display='none'
18                     document.getElementById('register').style.display='block'
19                     "><a href="#">Register</a>
20                 </li>
21                 <li onclick="
22                     document.getElementById('register').style.display='none'
23                     document.getElementById('login').style.display='block'
24                     "><a href="#">Log In</a>
25                 </li>
26             </ul>
27         </div>
28     </div>
29     <h1 style="font-family:Brush Script MT;">E-Health Management System</h1>
30     <tr>
31         <div id="header-menu2">
32             <ul id="menu-ul">
33                 <li><a href="#">Home</a>
34             </li>

```

```

<html>
<head>
<link rel="stylesheet" type="text/css" href="index.css">
<link rel="stylesheet" type="text/css" href="indexbody.css">
<script src="index.js"></script>
<title>HMS</title>
</head>
<center><body>
<header>
<div id="header-div1">
    
    <div id="header-menu1">
        <ul id="menu-ul">
            <li onclick="

```

```

document.getElementById('login').style.display='none'

document.getElementById('register').style.display='block'

        " ><a href="#">Register</a></li>
        <li onclick="

document.getElementById('register').style.display='none'

document.getElementById('login').style.display='block'
        "><a href="#">Log In</a></li>

                </ul>
        </div>
        <h1 style="font-family:Brush Script MT;">E-Health Management
System</h1><tr>
        <div id="header-menu2">
                <ul id="menu-ul">
                        <li><a href="#">Home</a></li>
                        <li><a href="#">About</a></li>
                        <li><a href="#">Doctors</a></li>
                        <li><a href="#">Appointments</a></li>
                        <li><a href="#">Contact</a></li>
                </ul>
        </div>
</div>
</header>
<!--.....-->
<div id="main-div">
        <table>
                <tr>
                        <td class="main-table"></td>

                        <td class="main-table">
                                <center><h1>About E-Health</h1></center>
                                <p style="padding-left:150px; text-align:justify;">we aim to provide excellence in medical care to all our patients.
                                We are dedicated to listening to you,
                                discussing your mental and physical
                                concerns in an honest and open fashion. We will provide you with up to date,
                                evidence-based medical advice to make
                                informed choices when it comes to managing your health. </p>
                        </td>
                </tr>
        </table>

```

```

</tr><br>
<tr>
  <td class="main-table">
    <center><h1>Doctors</h1></center>
    <p style="padding-right:150px; text-align:justify;">we aim to provide excellence in medical care to all our patients.
    We are dedicated to listening to you,
    discussing your mental and physical
    concerns in an honest and open fashion. We will provide you with up to date,
    evidence-based medical advice to make
    informed choices when it comes to managing your health. </p>
  </td>
  <td class="main-table"></td>

```

```

</tr><br><br>
<tr>
  <td class="main-table"></td>
  <td class="main-table">
    <center><h1>Appointment</h1></center>
    <p style="padding-left:150px; text-align:justify;">we aim to provide excellence in medical care to all our patients.
    We are dedicated to listening to you,
    discussing your mental and physical
    concerns in an honest and open fashion. We will provide you with up to date,
    evidence-based medical advice to make
    informed choices when it comes to managing your health. </p>
  </td>

```

```

</tr><br><br>
</table><br><br>
<table>
  <tr>
    <td class="main-table-2nd">
      <div class="main-table-2nd-div">
        <br>
        <center><h2>Blood Test</h2></center>
        <p style="padding:10px; text-align:justify;">We aim to provide excellence in medical care to all our patients.
        We are dedicated to listening to you,
        discussing your mental and physical
        concerns in good fashion. </p>
      </div>
    </td>
    <td class="main-table-2nd">

```



```

<div class="main-table-2nd-div">
    
        <center><h2>Xray</h2></center>
        <p style="padding:10px; text-
align:justify;">We aim to provide excellence in medical care to all our patients.
        We are dedicated to listening to you,
        discussing your mental and physical
concerns in good fashion. </p>
    </div>
</td>
<td class="main-table-2nd">
    <div class="main-table-2nd-div">
        
            <center><h2>Surgery</h2></center>
            <p style="padding:10px; text-
align:justify;">We aim to provide excellence in medical care to all our patients.
            We are dedicated to listening to you,
            discussing your mental and physical
concerns in good fashion. </p>
        </div>
    </td>
<td class="main-table-2nd">
    <div class="main-table-2nd-div">
        
            <center><h2>Book
Appointment</h2></center>
            <p style="padding:10px; text-
align:justify;">We aim to provide excellence in medical care to all our patients.
            We are dedicated to listening to you,
            discussing your mental and physical
concerns in good fashion. </p>
        </div>
    </td>
</tr>
</table>

</div><br><br>
<center><div id="login" class="magadiv">
<h1 style="float:left; margin-left:100; "> Log In </h1><br></br><br>
    <form action="login.php" class="form" method="post">

```

```

        <button type="button" style="background-color:red; width:50; border-radius: 100px
100px; "
onclick="document.getElementById('login').style.display='none'">X</button><br><br></br>
        <label><b>Username</b></label><br><br>
        <input type="text" placeholder="Enter Email" name="email" required><br><br><br>
        <label><b>Password</b></label><br><br>
        <input type="password" placeholder="Enter Password" name="password"
required><br><br><br>
        <button type="submit">Login</button><br><br><br>
</form>
</div></center>

```

```

<center><div id="register" class="magadiv">
    <h1 style="float:left; margin-left:100;"> Register </h1><br></br><br>
    <form action="register.php" class="form" method="post">
    <button type="submit" style="background-color:red; width:50; border-radius: 100px 100px; "
onclick="document.getElementById('register').style.display='none'">X</button><br><br></br>

```

```

        <label><b>Name</b></label><br><br>
        <input type="text" placeholder="Enter First name" name="name" required><br><br>

```

```

        <label><b>Contact No:</b></label><br><br>
        <input type="text" placeholder="Enter Contact No:" name="number" required><br><br>

```

```

        <label><b>Email</b></label></br></br>
        <input type="email" placeholder="Enter Username" name="email" required><br><br>
        <label><b>Password</b></label><br><br>
        <input type="password" placeholder="Enter Password" name="password"
required><br><br><br>
        <button type="submit">Register Me!</button><br><br><br>

```

```

</form>

```

```

</div></center>

```

```

<!-- ..... footer.....-->

```

```

<footer>
<div id="footer-div">
    <div id="footer-content-div">
        <table id="footer-table-id">
            <tr>
                <td class="footer-table">
                    <ul class="footer-list">
                        <br><br>

```

```

<li><a href="#">Home</a></li>
<li><a href="#">About</a></li>
    <li><a href="#">Doctors</a></li>
    <li><a href="#">Appointments</a></li>
    <li><a href="#">Contact</a></li>
</ul>
</td>
<td class="footer-table">
    <ul class="footer-list">
        <br><br>
        <li><a href="#">Home</a></li>
        <li><a href="#">About</a></li>
        <li><a href="#">Doctors</a></li>
        <li><a href="#">Appointments</a></li>
        <li><a href="#">Contact</a></li>
    </ul>
</td>
<td class="footer-table">
    <ul class="footer-list">
        <br><br>
        <li><a href="#"><b>Contact Details</b></a></li>
        <li><a href="#">E-Health Management
System</a></li>
        <li><a href="#">Ph: +353 899659857</a></li>
        <li><a href="#">Email:
toorhusnain@gmail.com</a></li>
        <li><a href="#">Address: Dublin, Ireland.</a></li>
    </ul>
</td>
</tr><br>
</table><br>
<tr><center><h2 style="color:black;">Copy Right 2018 Husnain Azeem Toor
</h2><center></tr>
</div>
</div>
</footer>
</body>
</center>
</html>

```

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