

COMSATS University Islamabad (CUI)

**Software Design Description
(SDS DOCUMENT)**

for

Orthodoc(Knee Osteoarthritis Detection)

Version 1.0

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Bachelor of Science in Computer Science (2019-2023)

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Revision History

Name	Date	Reason for changes	Version

Application Evaluation History

Comments (by committee) *Include the ones given at scope time both in doc and presentation	Action Taken
Implementation is not 40% Sequence diagrams are not mapped with class diagrams. AI model algorithm is not defined.	Corrected Sequence diagrams. Defined AI algorithm.

Supervised by
Umar Nauman

Signature _____

1. Introduction

This project intends to help the patients mainly to make them at ease. Patients usually find it troublesome to approach the nearby doctors in time and get medical assistance in emergency. Not only this but booking an appointment manually also makes it frustrating for the individuals. Therefore, our project is confined to assist the patients by helping them book the appointment online. This way the system will reduce the wait time for other patients by helping multiple individuals at the same time. This means that more than one patient can book their appointment together irrespective of the manual appointment system in which patients have to wait for so long to register themselves.

Firstly, this project will aid the patients to detect their osteoarthritis disease at home by uploading X-Rays minimizing the patient's effort to go to the doctor and do everything manually.

Secondly, all these operations can be performed when patient will create his/her profile to access the features of system. After creating an account, the patient will also be able to edit his/her profile, search for the doctors and book an appointment.

Thirdly, he/she will be capable of uploading his/her x-rays to the system to detect the osteoarthritis disease.

Next, the patients will also be able to communicate with doctor through live chat. Not only this but the individuals will get basic level emergency assistance from chatbot too. Last but not the least, the patient can give feedback about the doctor's treatment, assisting the other patients to make the decision about the doctor easily.

On the other hand, talking about the manual system, it is similarly exhausting for the doctors to keep the patients' records safe so that they are not easily misplaced. Not only this but the modifications in patient's records also take a lot of time.

Along with serving the patient, our project also aims to help doctors by providing them with a platform where they can manage the patients' records in an automated way. As far as the record of the patients is concerned, it includes the visited history of patient, reports and prescription generated by system. Lastly, Doctor can create, and modify his/her profile, upload X-Ray image of patient, generate report and create prescription for patient.

2. Design Methodology and Software Process Model

Procedural methodology and **Object-Oriented Programming** both will be used in our project. AI Machine learning model will be trained by using OOP approach and the rest of the project will use procedural methodology.

Rationale:

The project is mainly using Procedural methodology as it is function-oriented, modular, and simple to understand. The module is broken down into smaller components and it focuses on procedures. While for machine learning model, the libraries that we are using provide the built-in classes that follows the

Object-Oriented Approach, so it is easy for us to use OOP in our system for developing machine learning code.

The **incremental model** will be our software process model for our project.

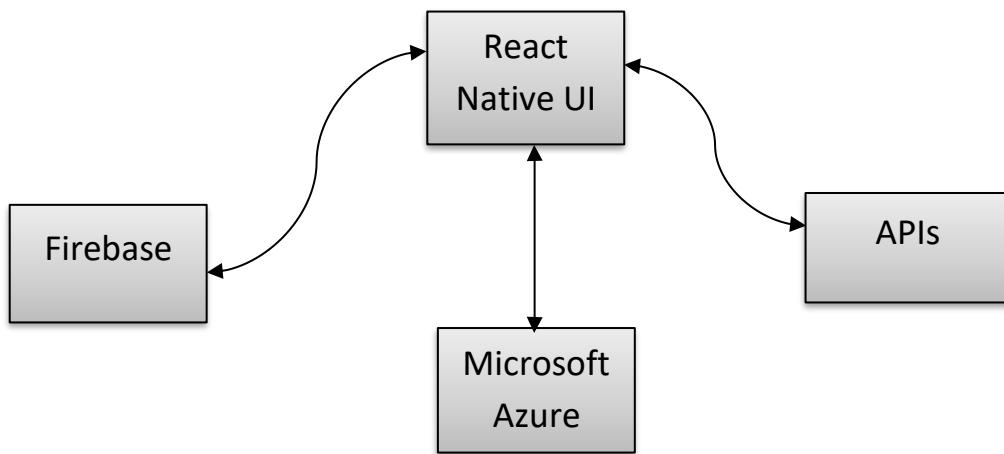
Rationale:

The rationale for choosing this approach is that we want our system to be created in small increments, with small by-products delivered. This methodology is chosen because it is easier to validate and test the short iterations. Another rationale for using the incremental model is that we want to start small with smaller by-products, then develop up to a high level, and finally to complete it.

3. System Overview

Orthodoc is a technology-based project that will assist patients in various ways. Firstly, the project aims letting the patients detect knee osteoarthritis anywhere, just they must upload their X-rays and the system will assist them with diagnosis. Secondly, Orthodoc will help patients have their desired appointment booked on some clicks. Orthodoc will also inform the patient about the severity level of osteoarthritis and do prescribe some temporary painkillers/medicine and some beneficial exercise that will help in relief pain. Thirdly, the patient will be able to be in touch with doctor and the doctor can update himself/herself after the visit of patient. Patient would also be able to get basic level of emergency assistance by Chatbot.

Architectural Design



4. Design Models

We will use activity diagram, data flow diagram, state transition diagram, class diagram and sequence diagram as design models.

4.1 Activity Diagrams

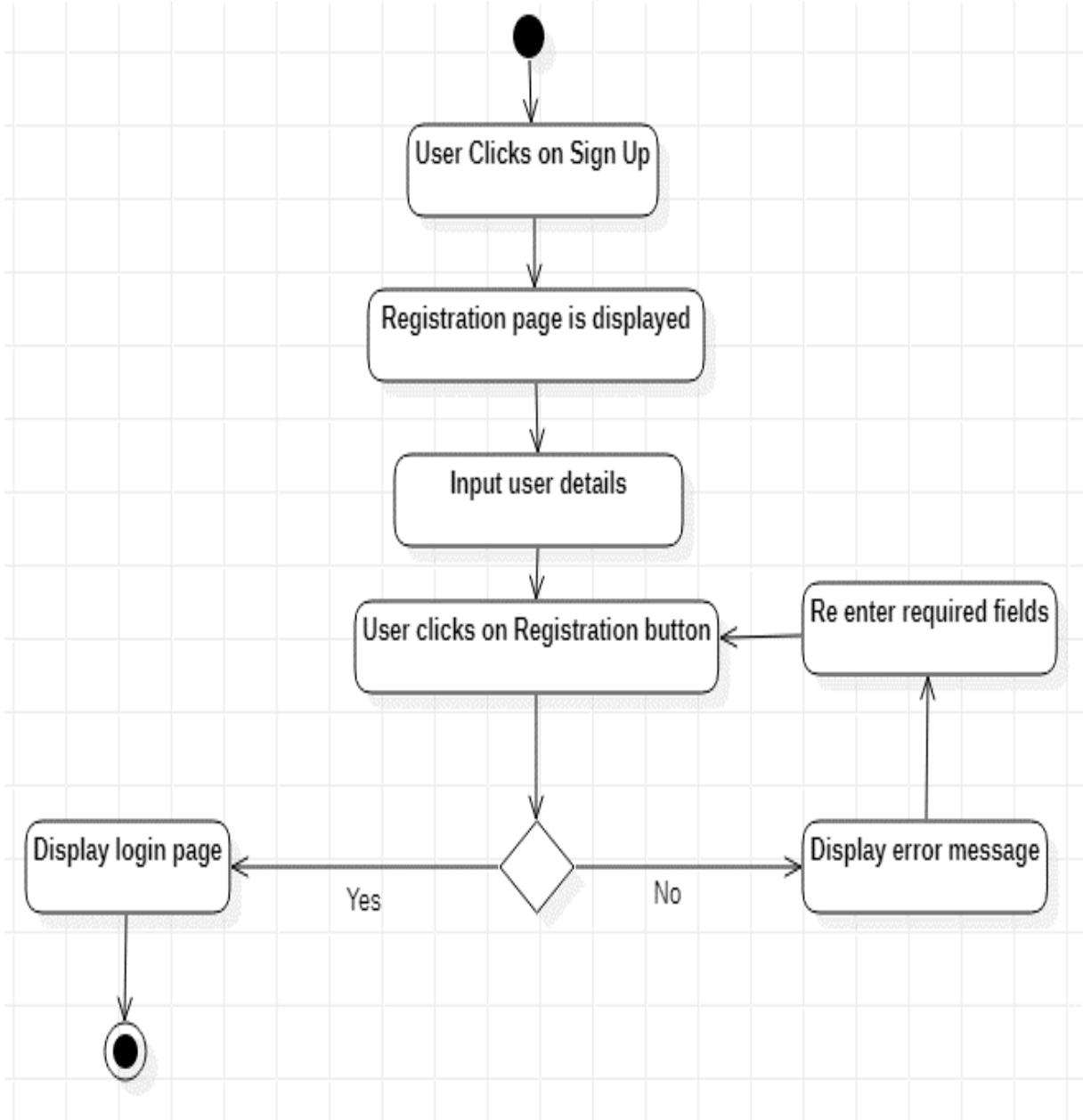


Figure 1: Register

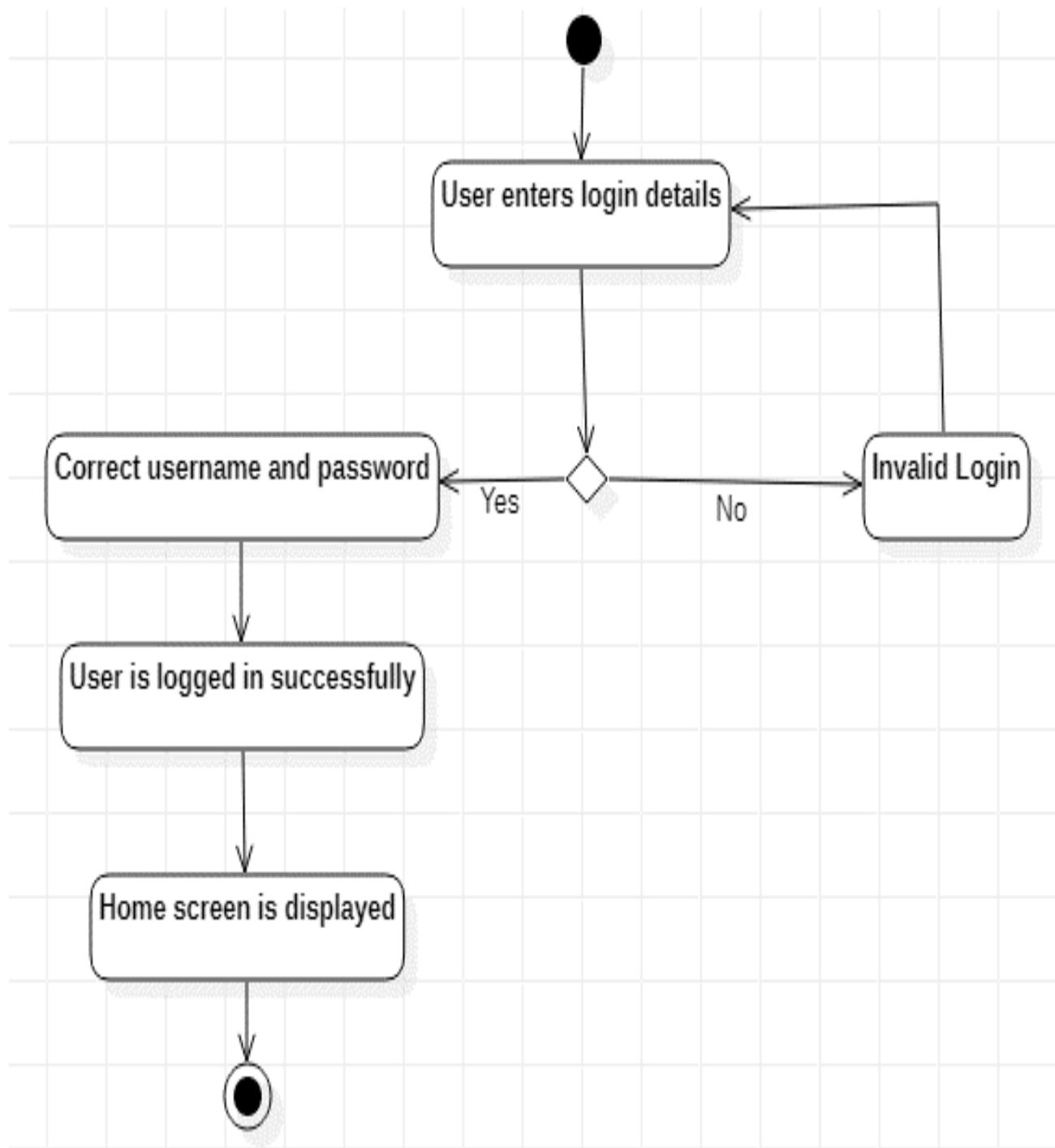


Figure 2:Login

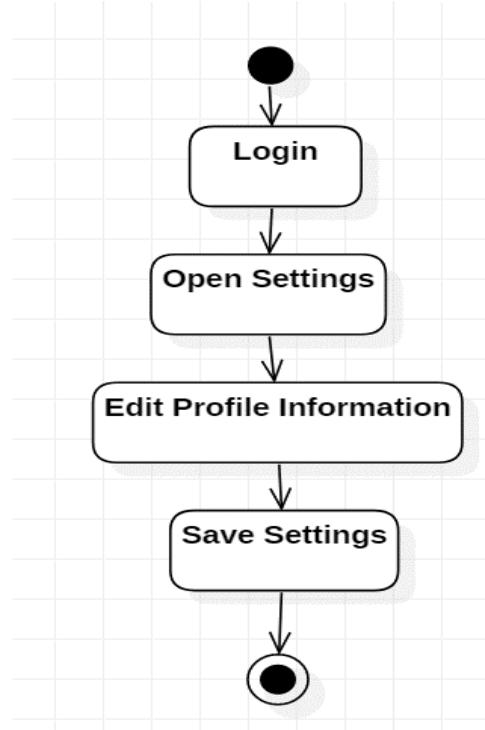


Figure 3:Edit Profile

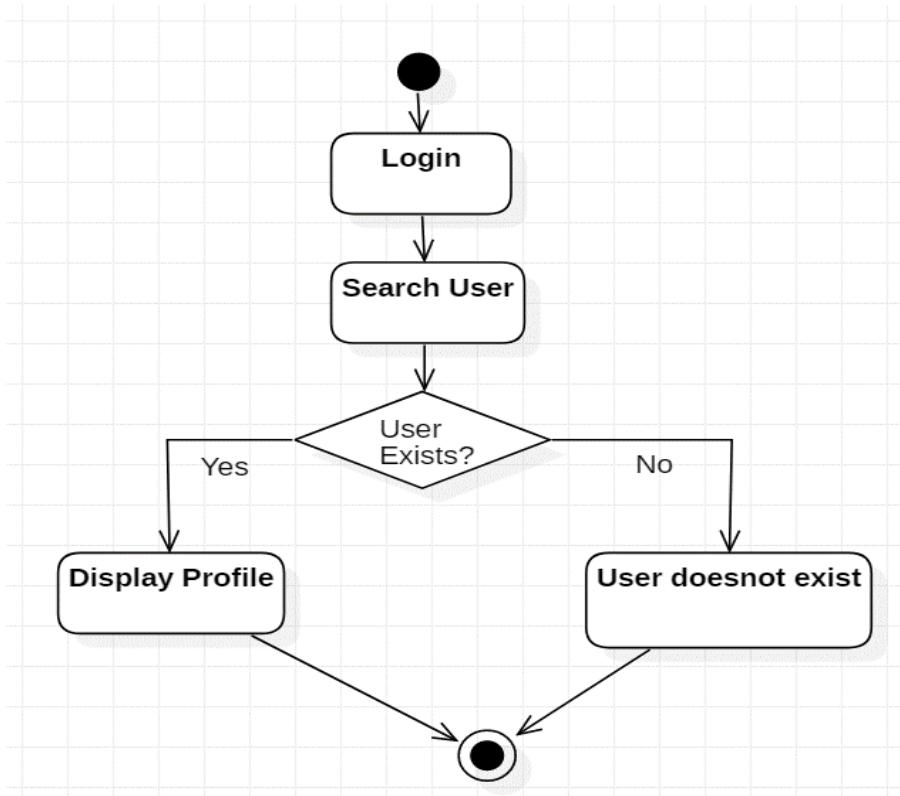


Figure 4:Search Profile

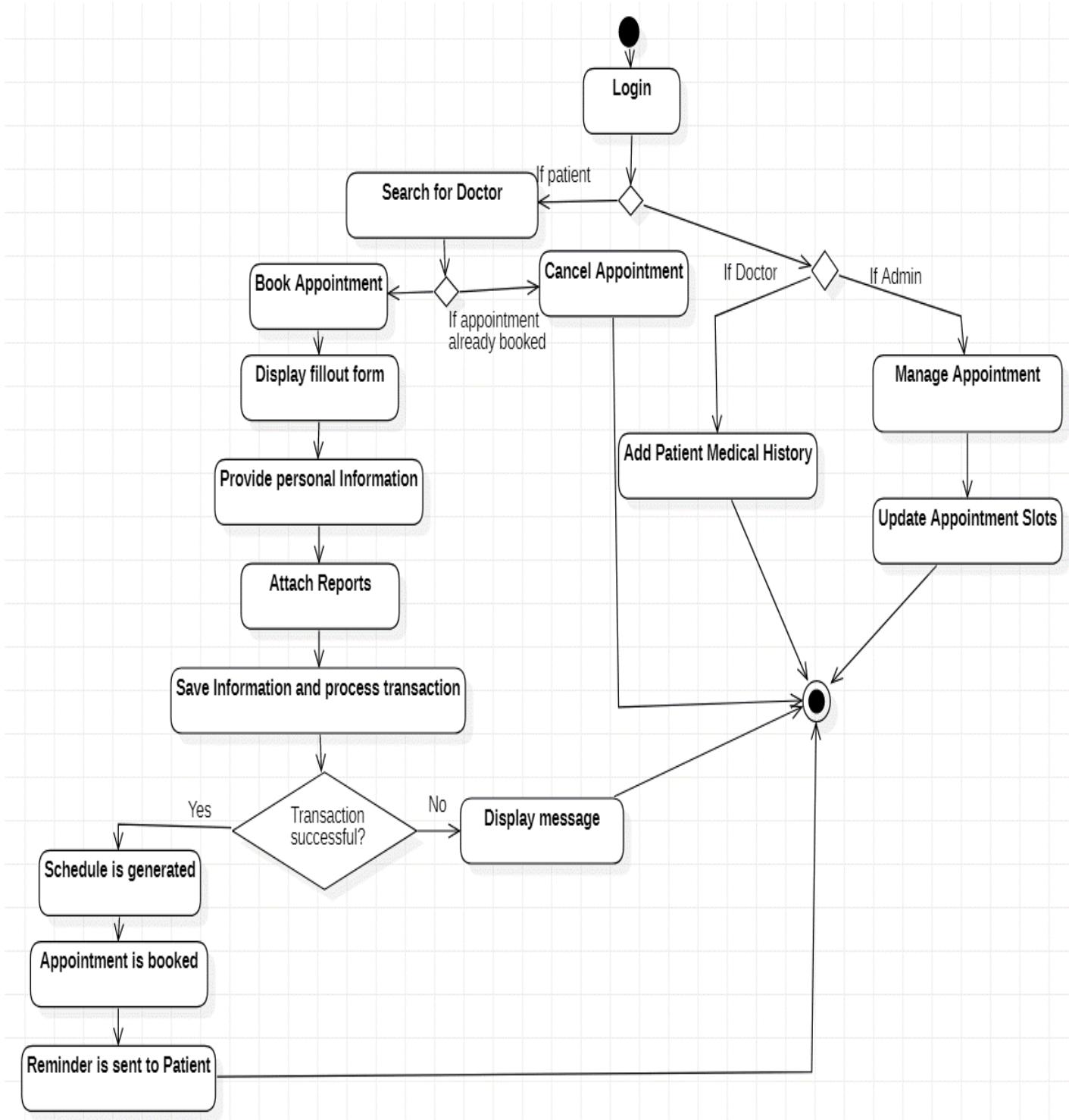


Figure 5:Book Appointment

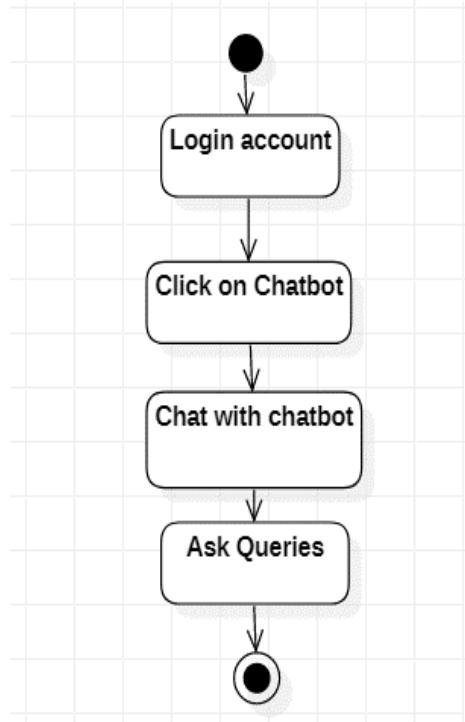


Figure 6:Chatbot

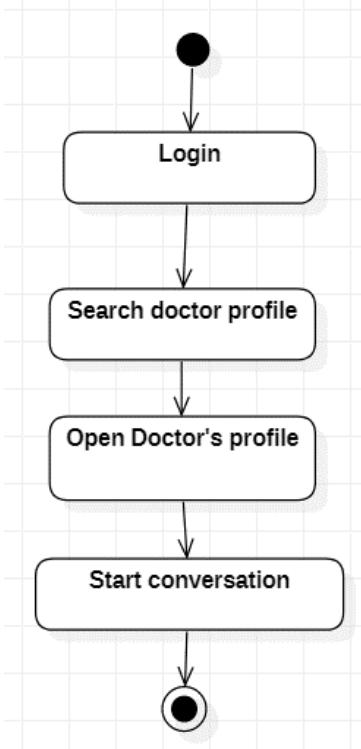


Figure 7:Chat with Doctor

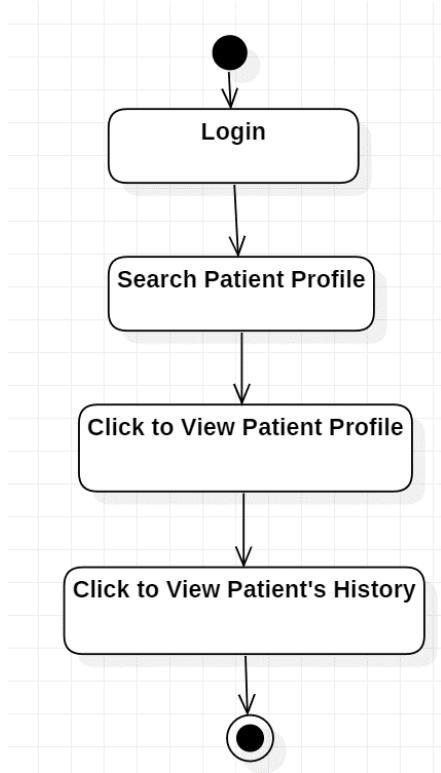


Figure 8:View Patient History

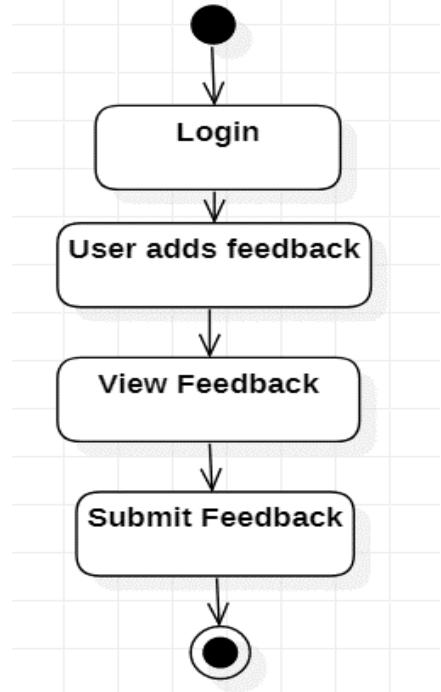


Figure 9:Feedback

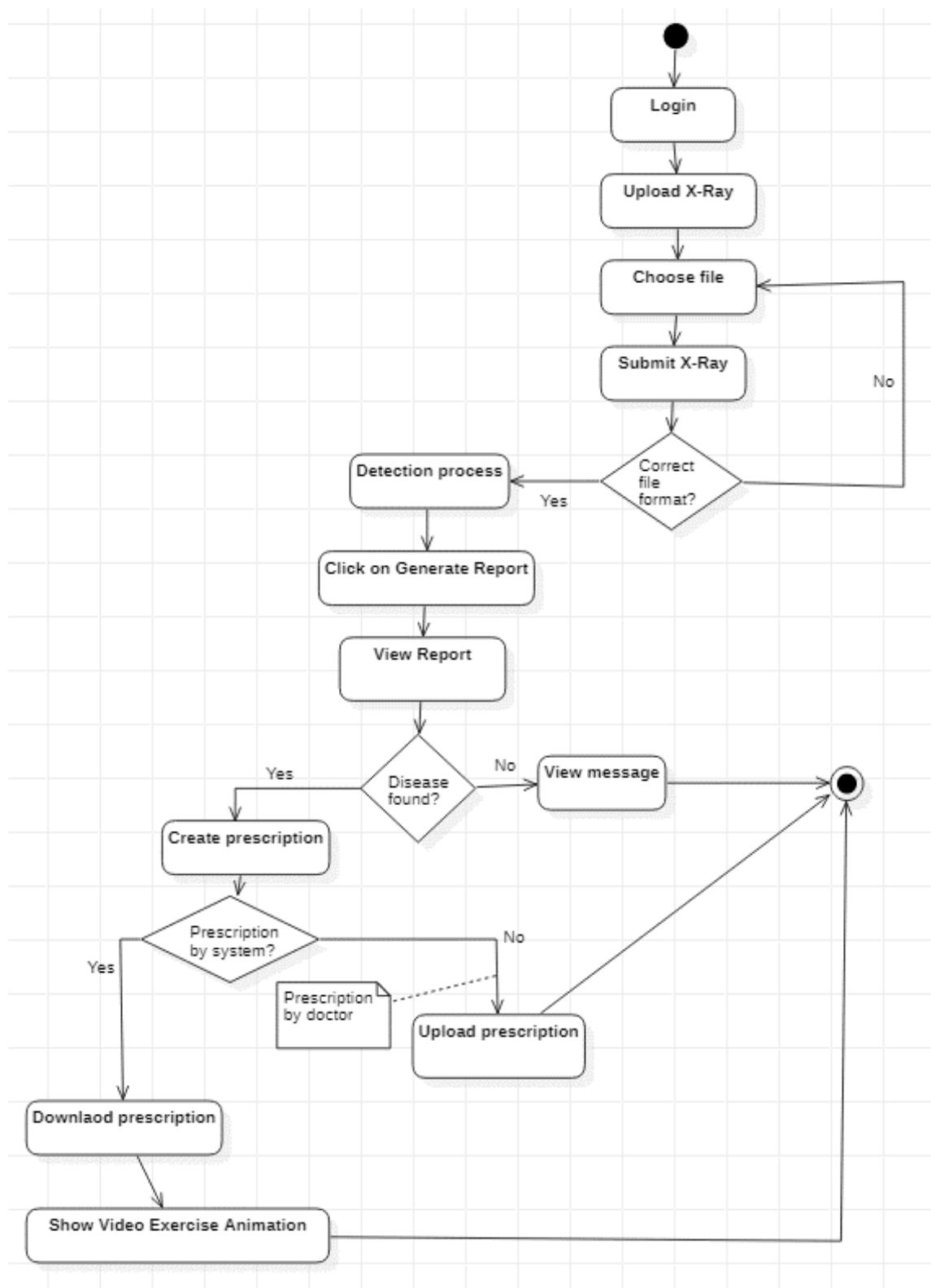


Figure 10:Disease Detection

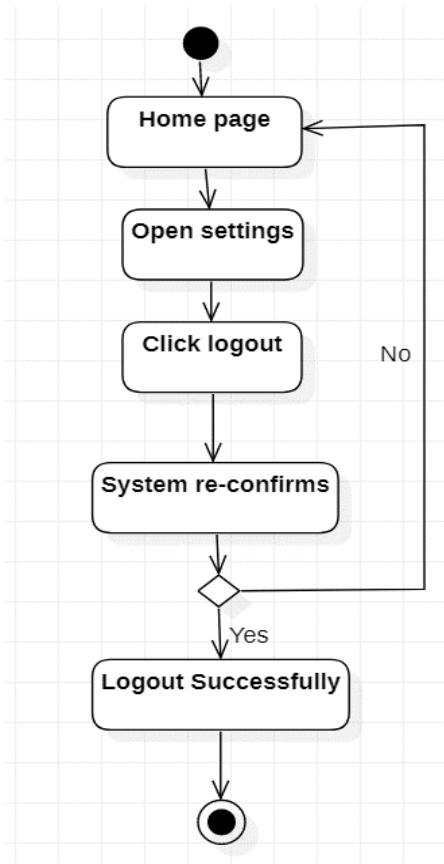


Figure 11:Logout

4.2 Data Flow Diagrams

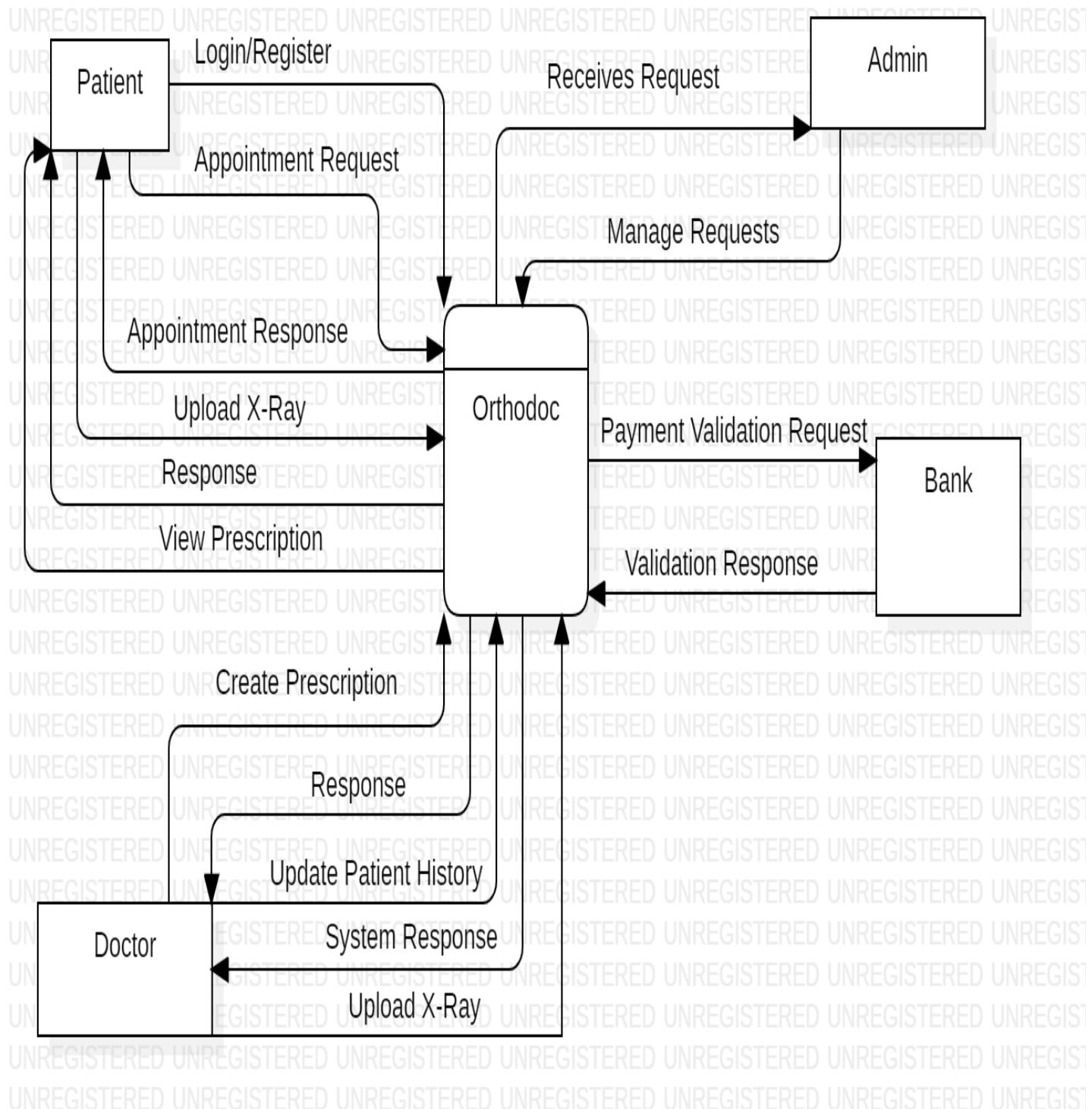


Figure 12: DFD Level-0

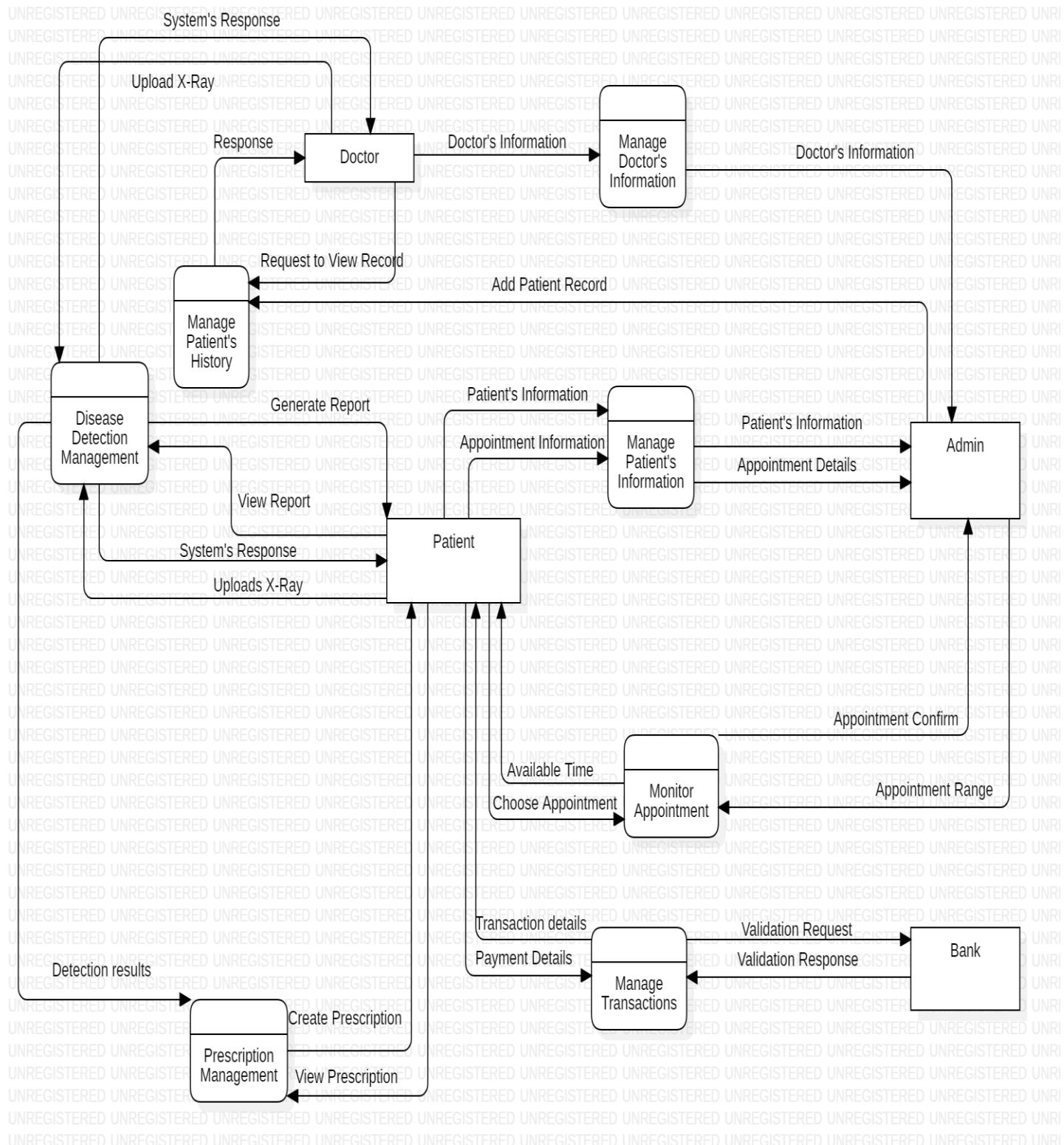


Figure 13:DFD Level-1

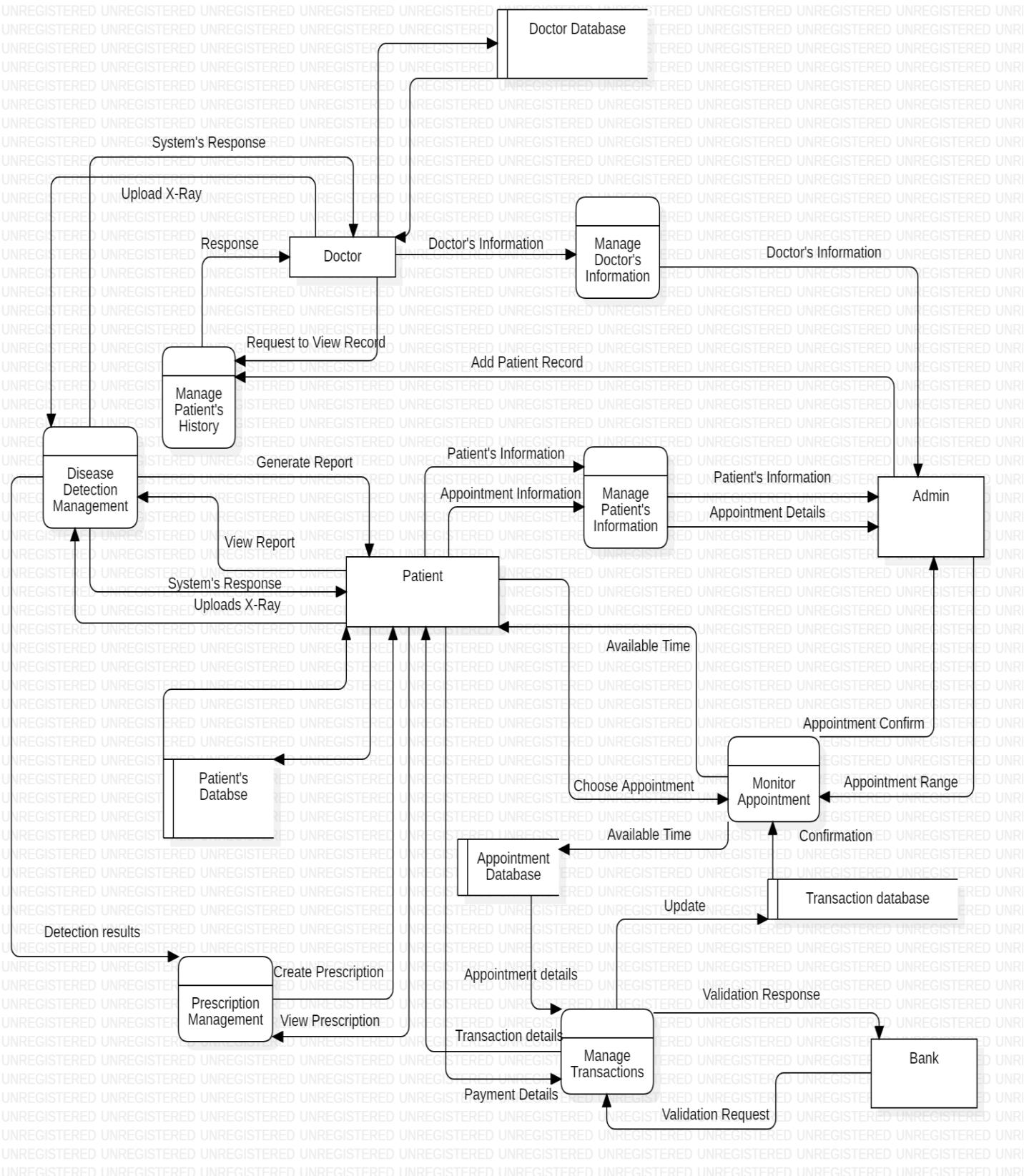


Figure 14:DFD Level-2

4.3 State Transition Diagram

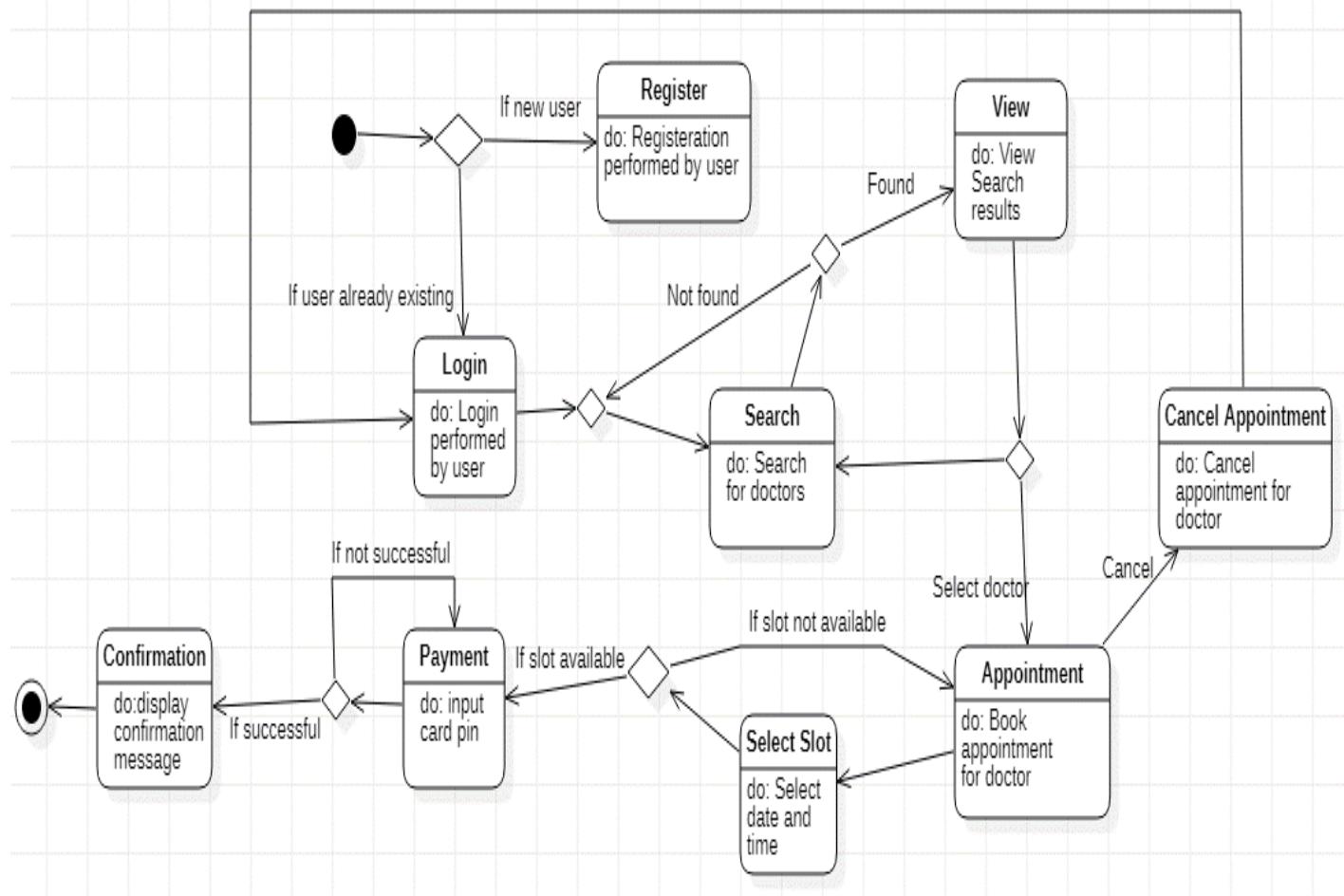


Figure 15:State Transition Diagram I

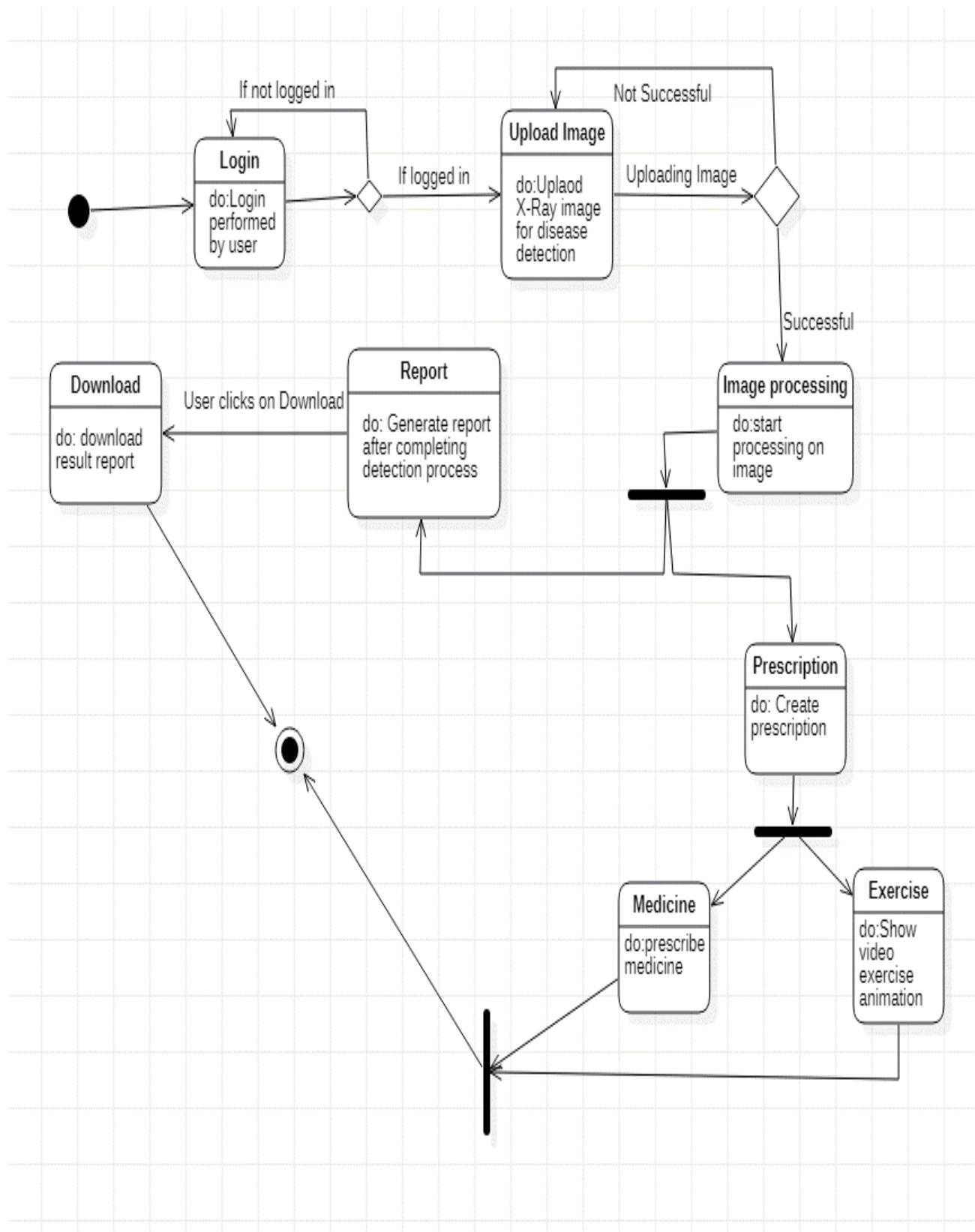


Figure 16: State Transition Diagram II

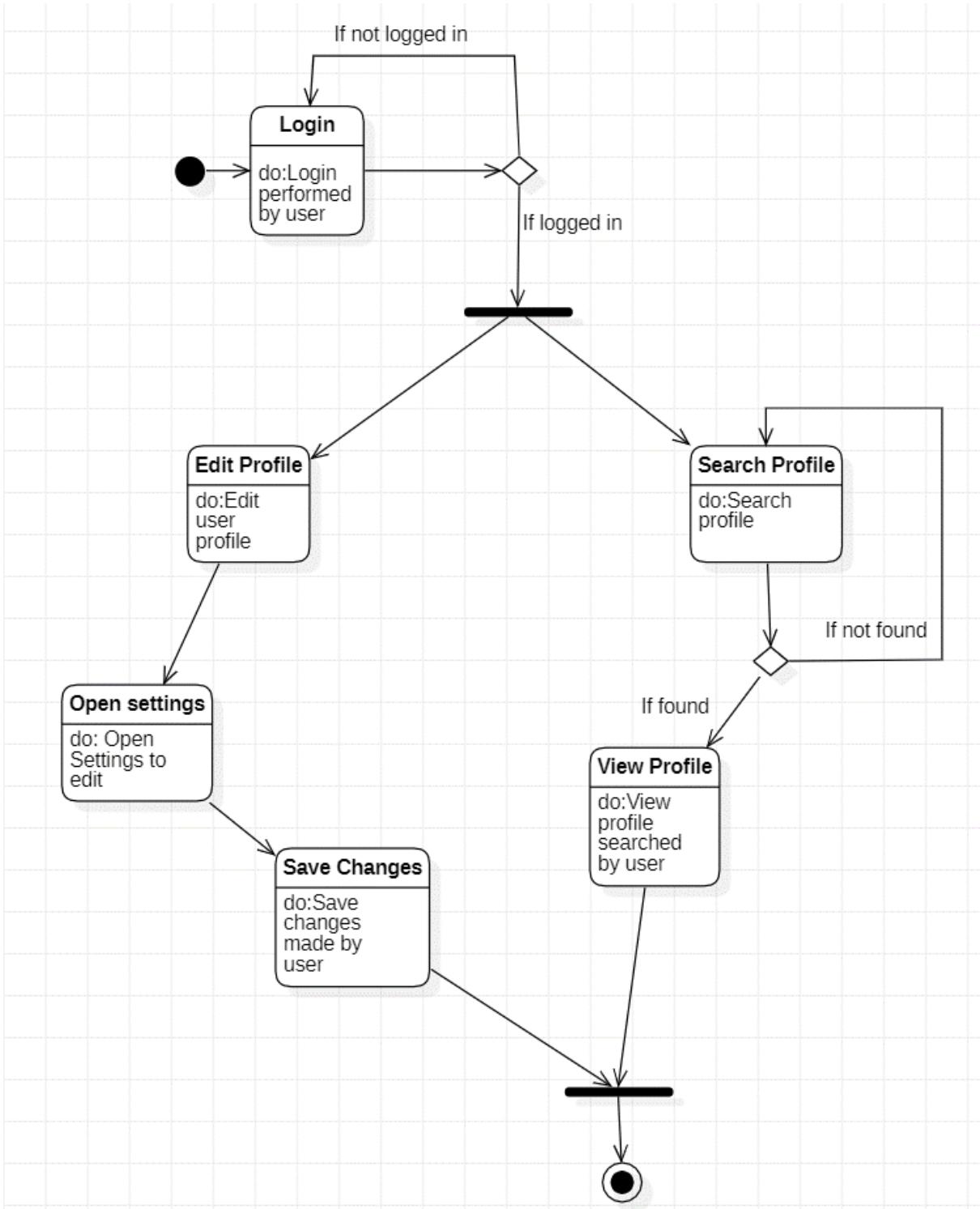


Figure 17: State Machine Diagram III

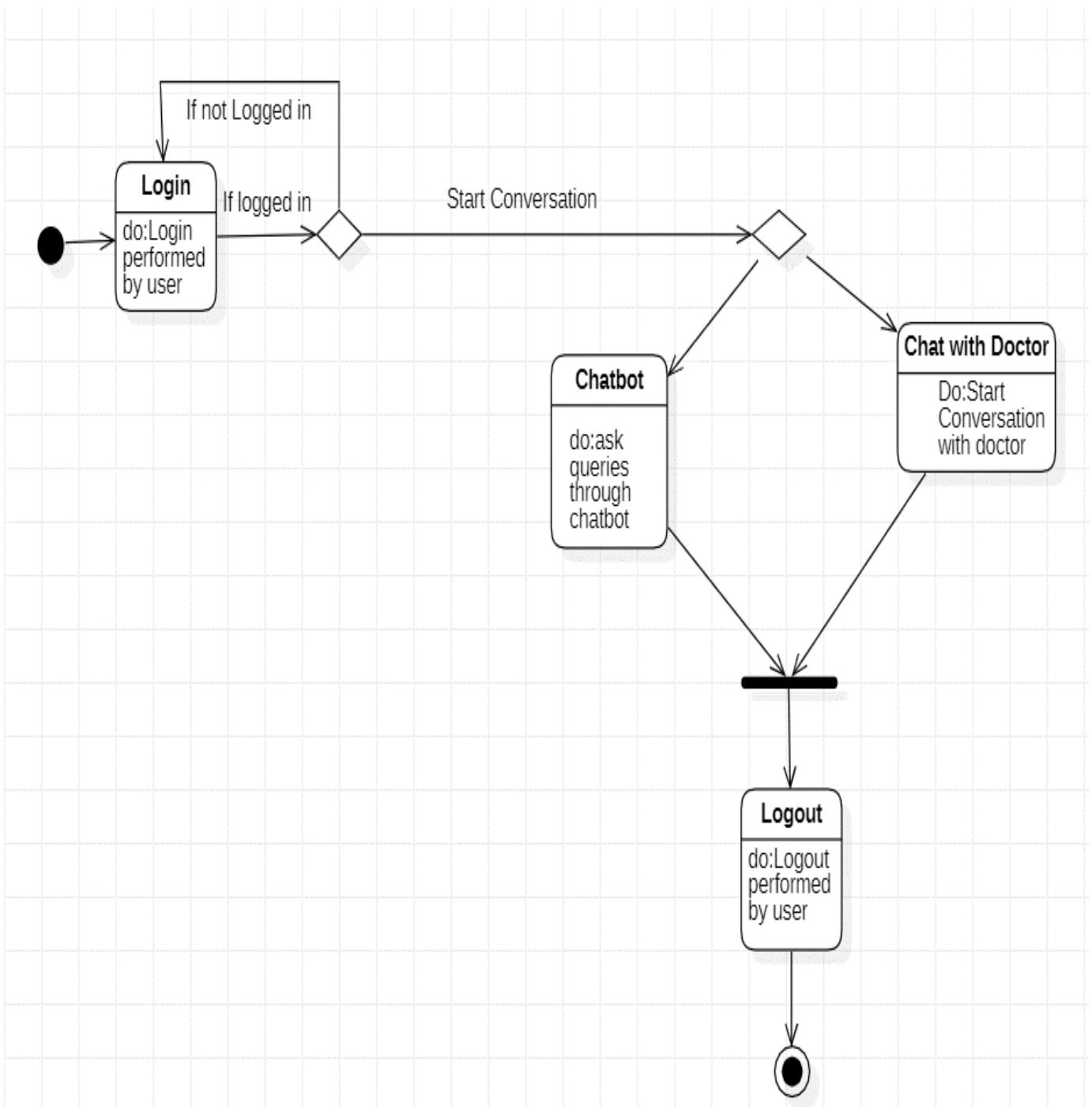


Figure 18: State Machine Diagram IV

4.4 Sequence Diagram

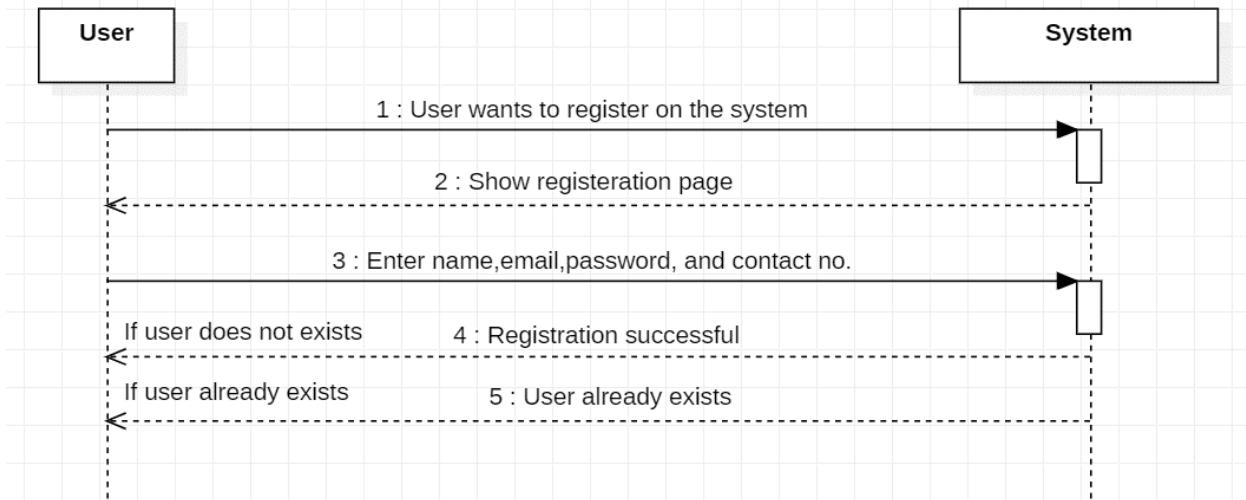


Figure 19:Registration

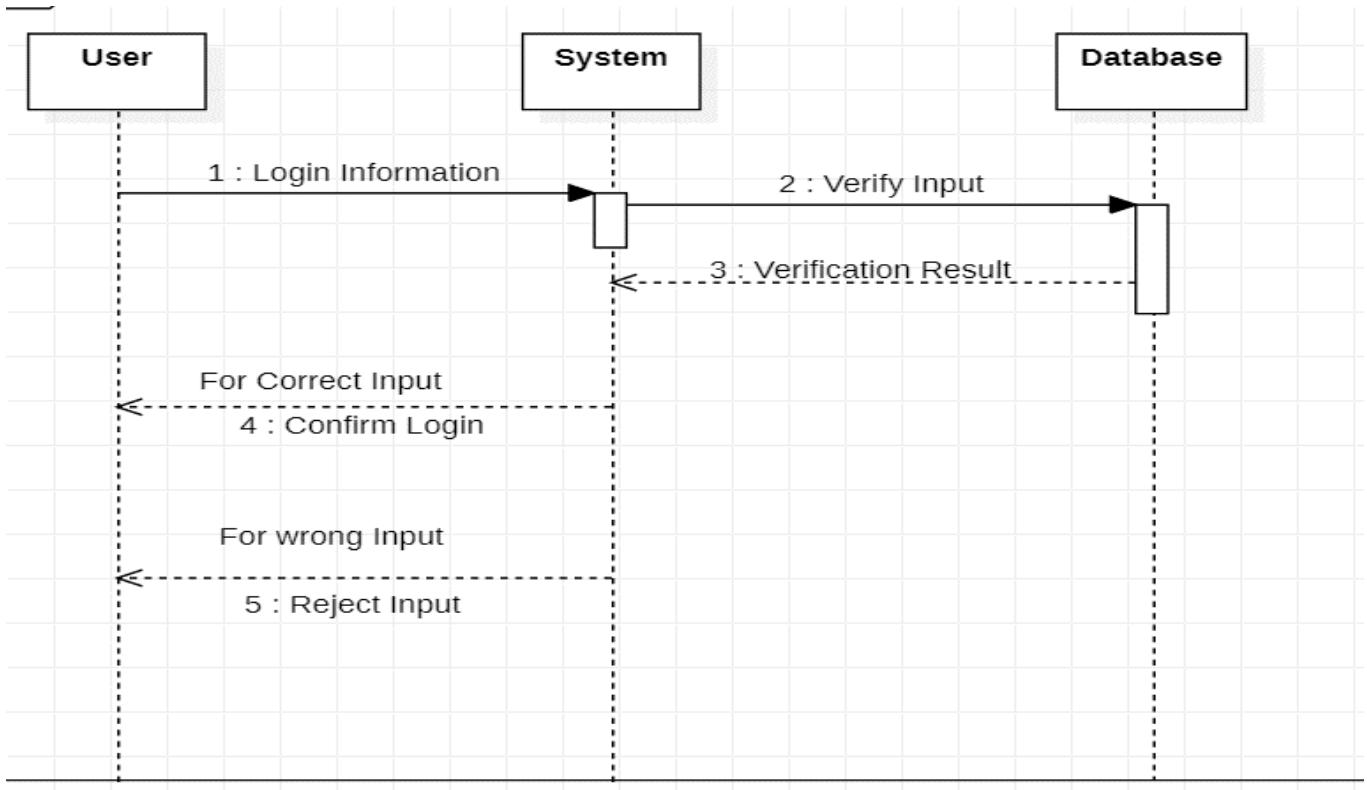


Figure 20:Login

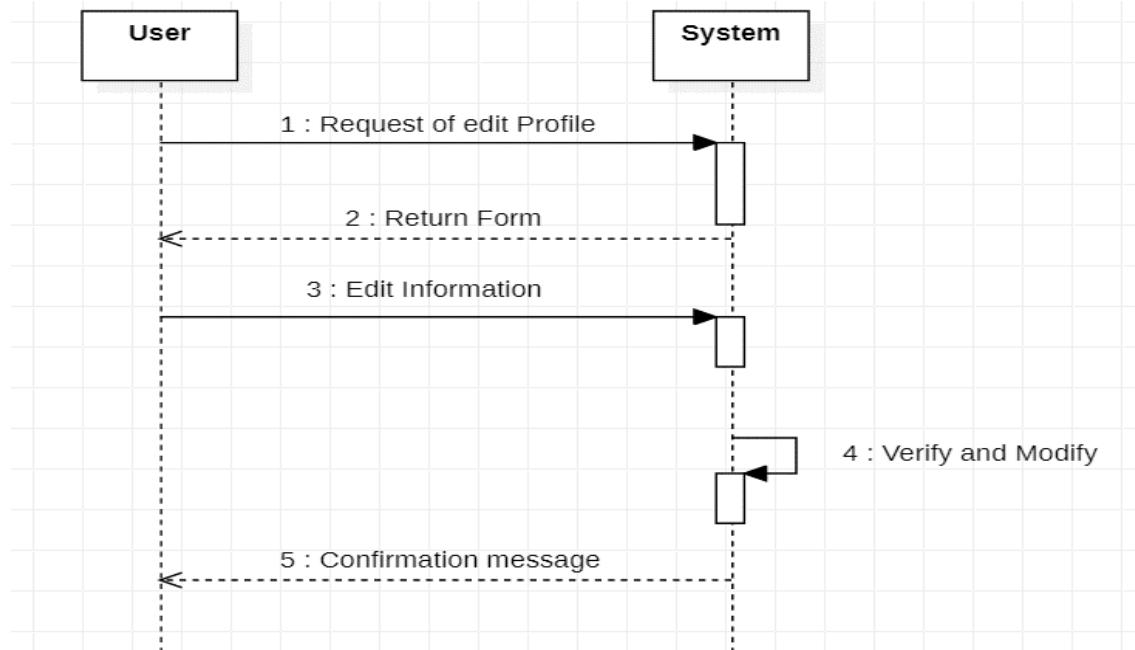


Figure 21:Edit Profile

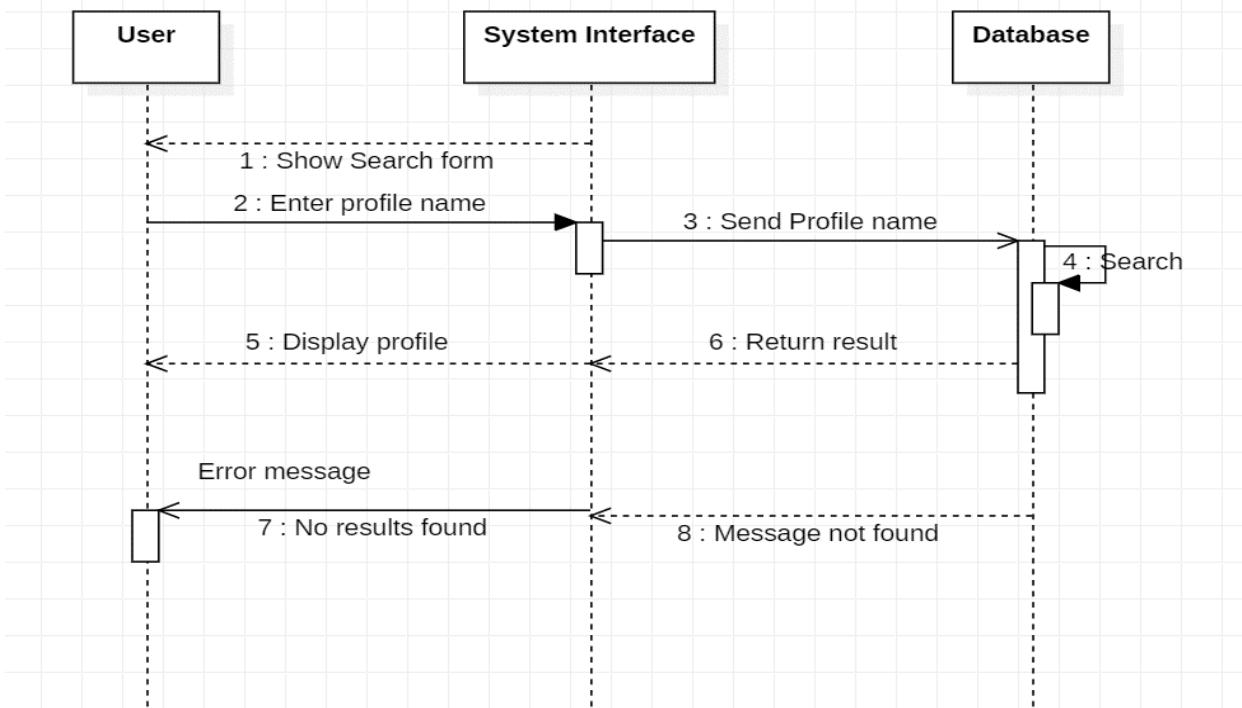


Figure 22:Search Profile

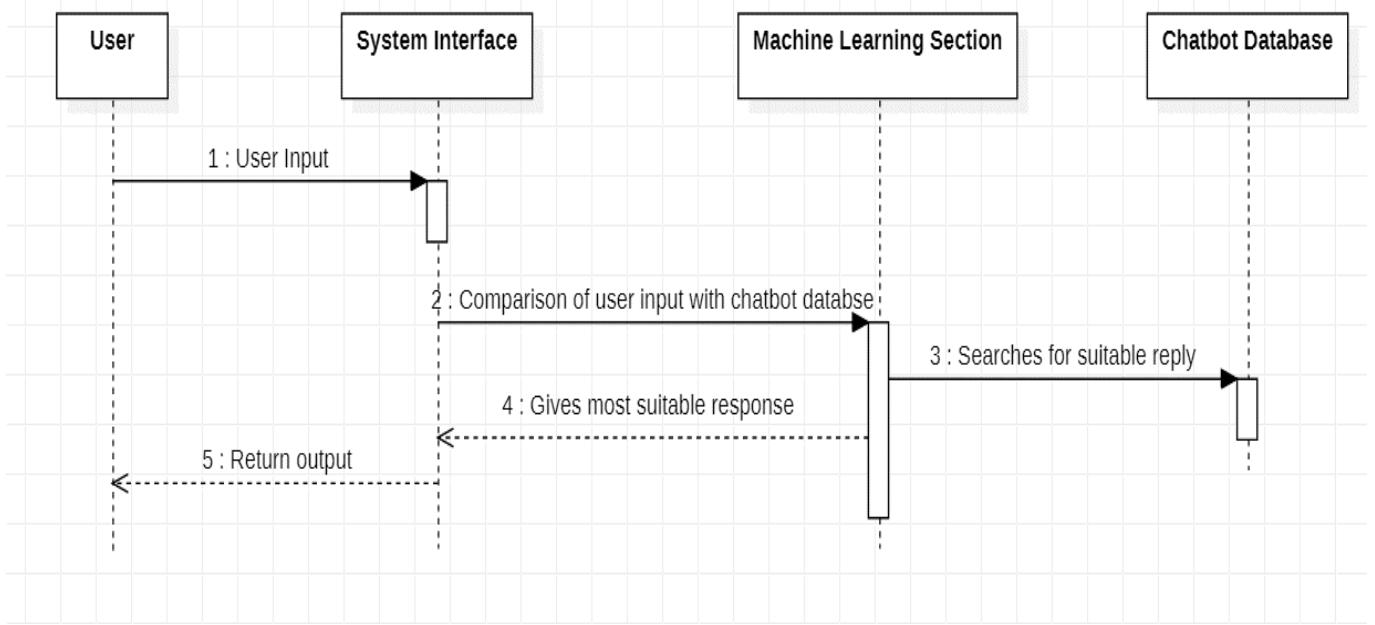


Figure 23:Chatbot

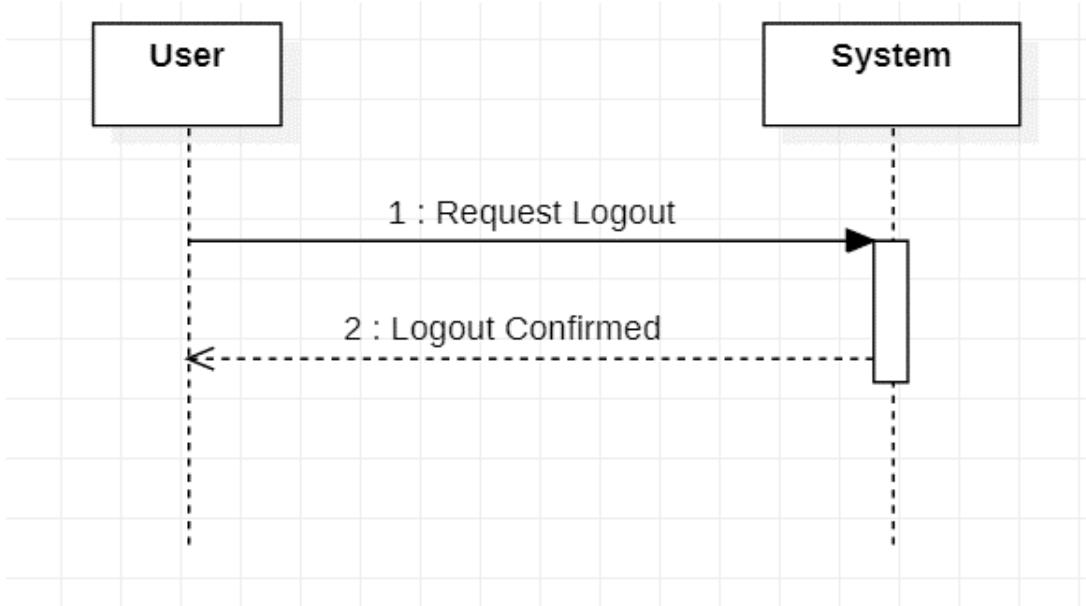


Figure 24:Logout

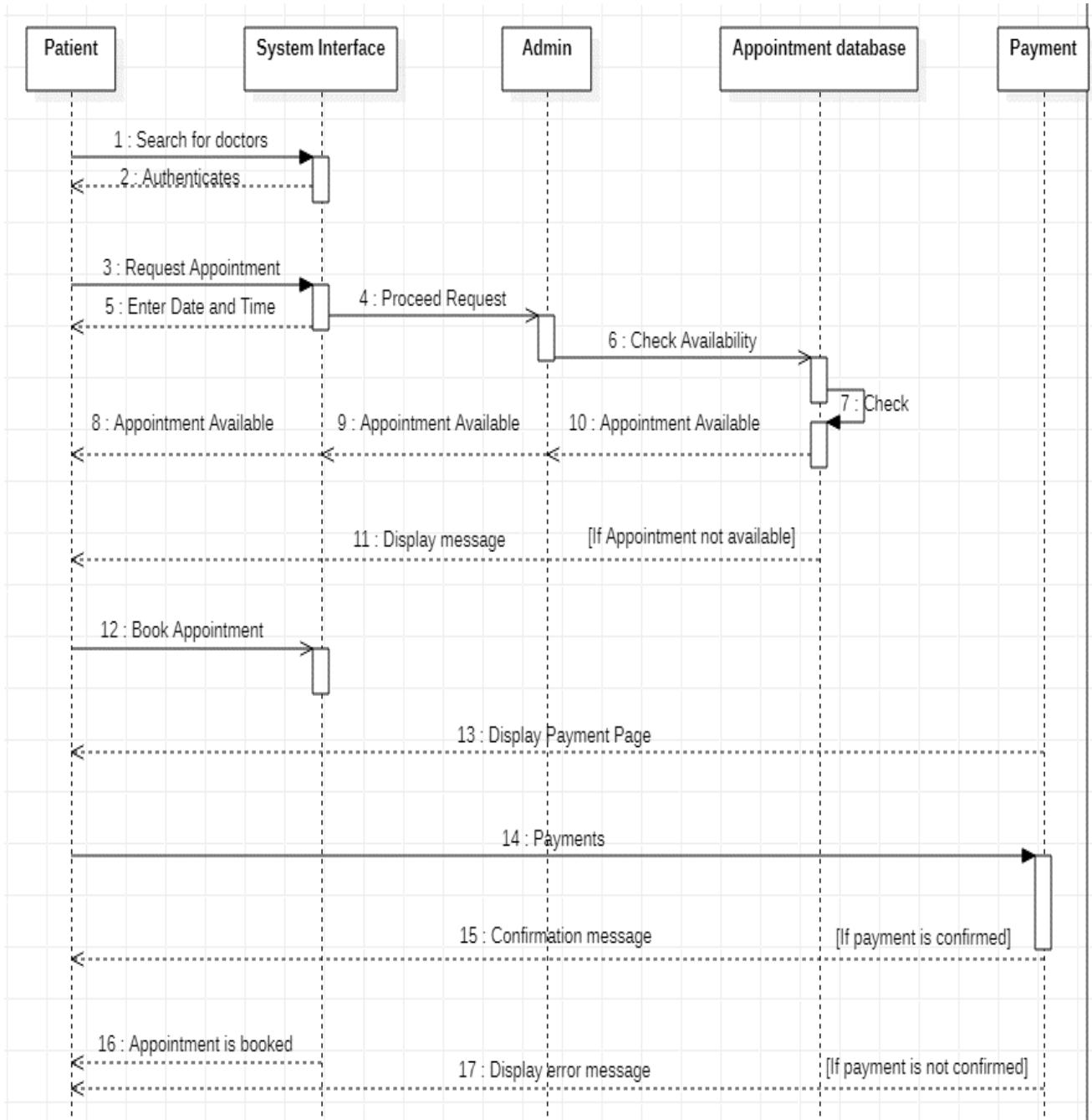
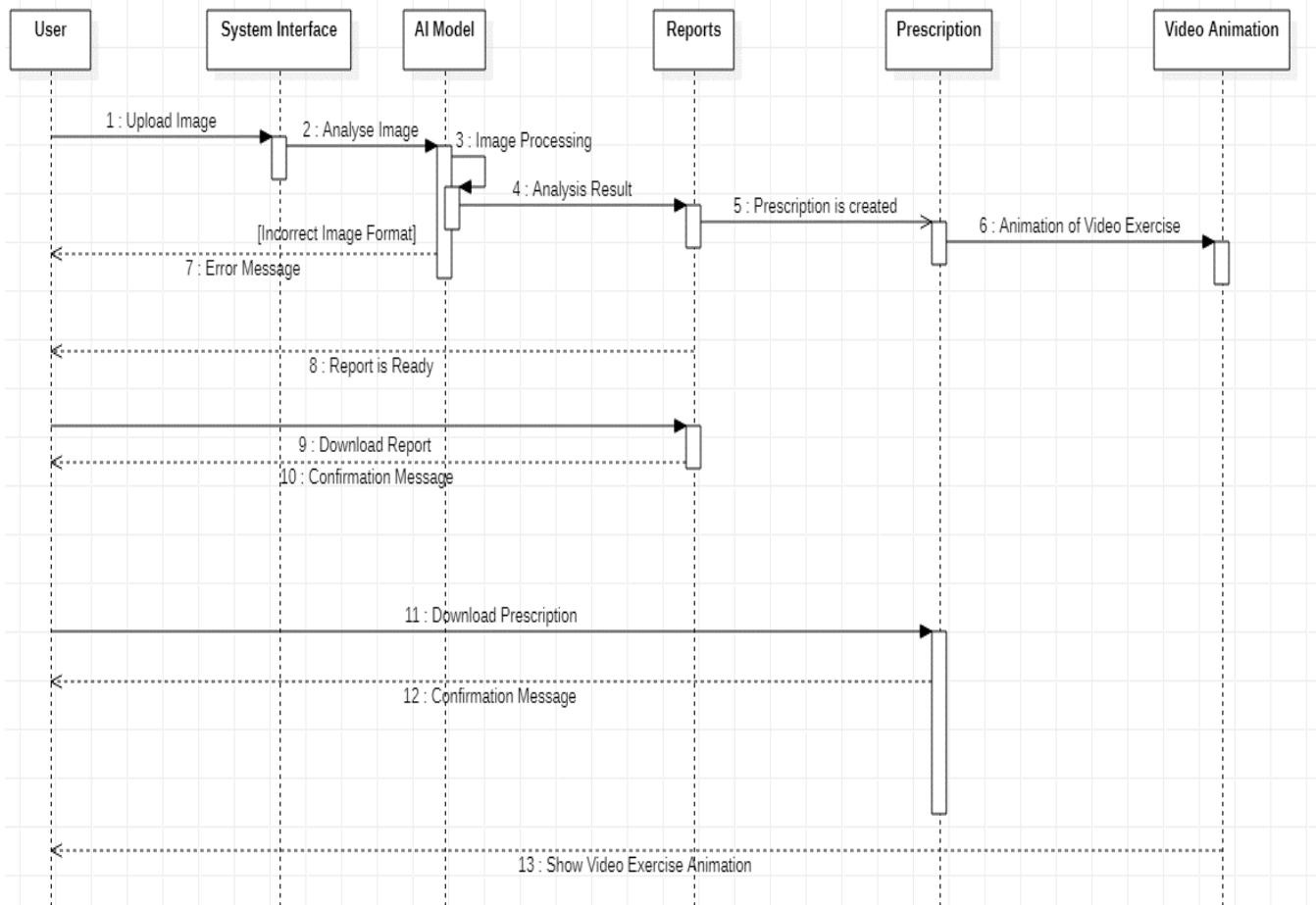


Figure 25:Book Appointment

**Figure 26:Disease Detection**

4.5 Class Diagram

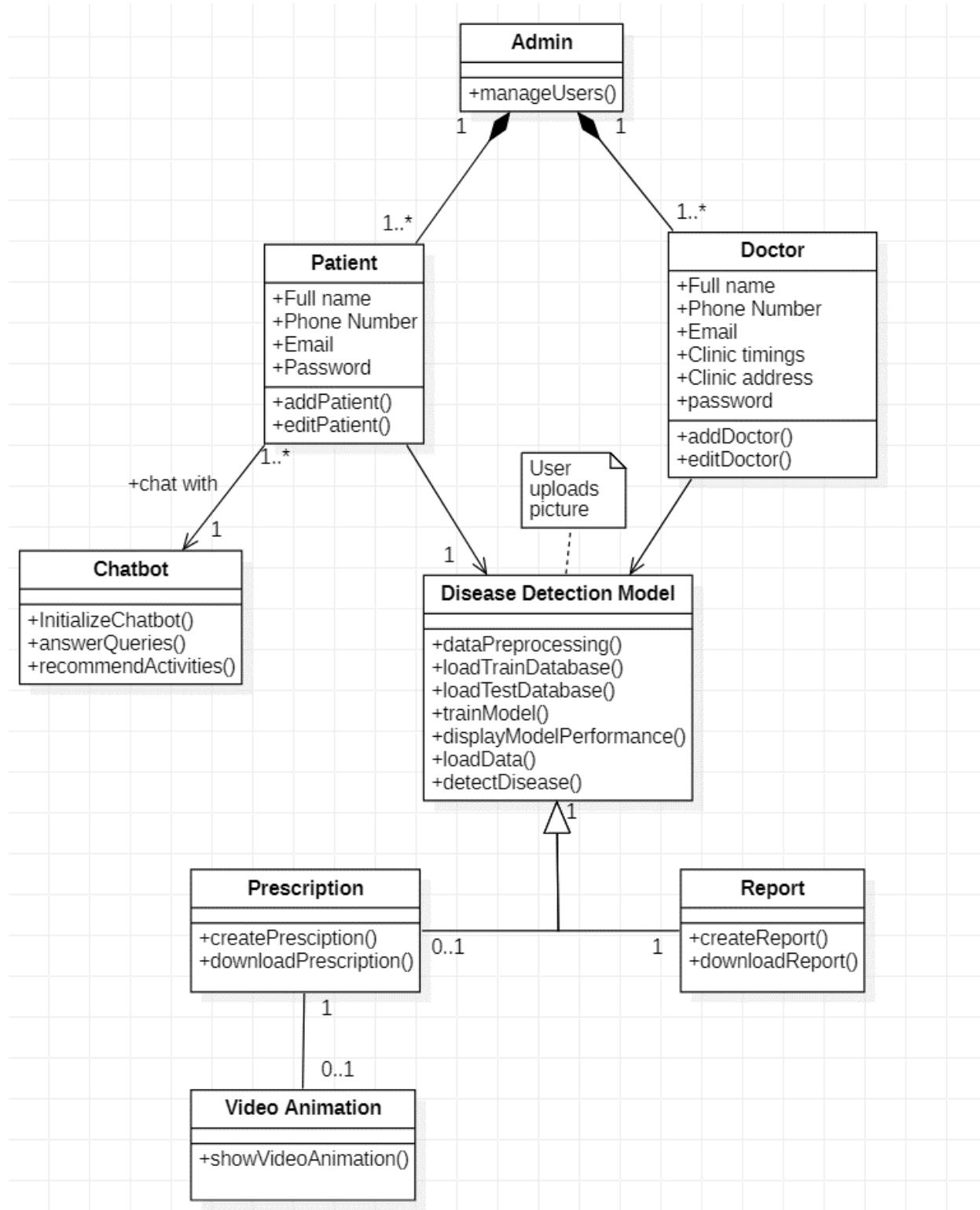


Figure 27:Class Diagram

5. Data Design

The database that will be used for our project is firebase. The data of the users will be stored in the form of JSON objects.

5.1 Data Dictionary

Table 1:Data Dictionary for Patient

Field Name	Data Type	Range of Values	Description
Id	Firebase Object id	20	Unique id of the patient
Full Name	String	50	Name of the patient
Phone number	String	15	Phone number of patient
Email	String	20	Email of the patient
Password	String	-	Password for account's security.

Table 2:Data Dictionary for Doctor

Field Name	Data Type	Range of Values	Description
Id	Firebase Object id	20	Unique id of the doctor
Full Name	String	50	Name of the doctor
Phone number	String	15	Phone number of the patient
Email	String	20	Email of the patient
Clinic address	String	50	Clinic address of doctor
Clinic timings	Date/Time	-	Timings of the clinic
Password	String	-	Password for account's security.

Table 3:Data Dictionary for Admin

Field Name	Data Type	Range of Values	Description
Id	Firebase Object id	20	Unique id of the patient
Name	String	50	Name of the admin
Email	String	20	Email of admin
Password	String	-	Password for security

6. Algorithms

We'll apply the CNN algorithm, which is mainly used in image recognition applications. As it relies less on pre-processing, less human effort is required to build its functionalities. It is simple to comprehend and quick to put into practice. Among all image classification algorithm, it has the highest accuracy.

6.1 CNN Algorithm

The convolutional Neural Network CNN works by gathering an image, giving it a weight based on the many features in the image, and then separating them from one another.

6.2 CNN Pseudo code

```
for each image row in input image:  
    for each pixel in image row:  
        set accumulator to zero  
        for each kernel row in the kernel:  
            for each element in the kernel row:  
  
                if element position corresponding to pixel position then  
                    multiply element value corresponding to pixel value  
                    add result to accumulators  
  
                end if  
            end for  
        end for  
    end for  
set output image pixel to accumulator
```

7. Human Interface Design

7.1 Screen Images



Figure 28:Splash Screen

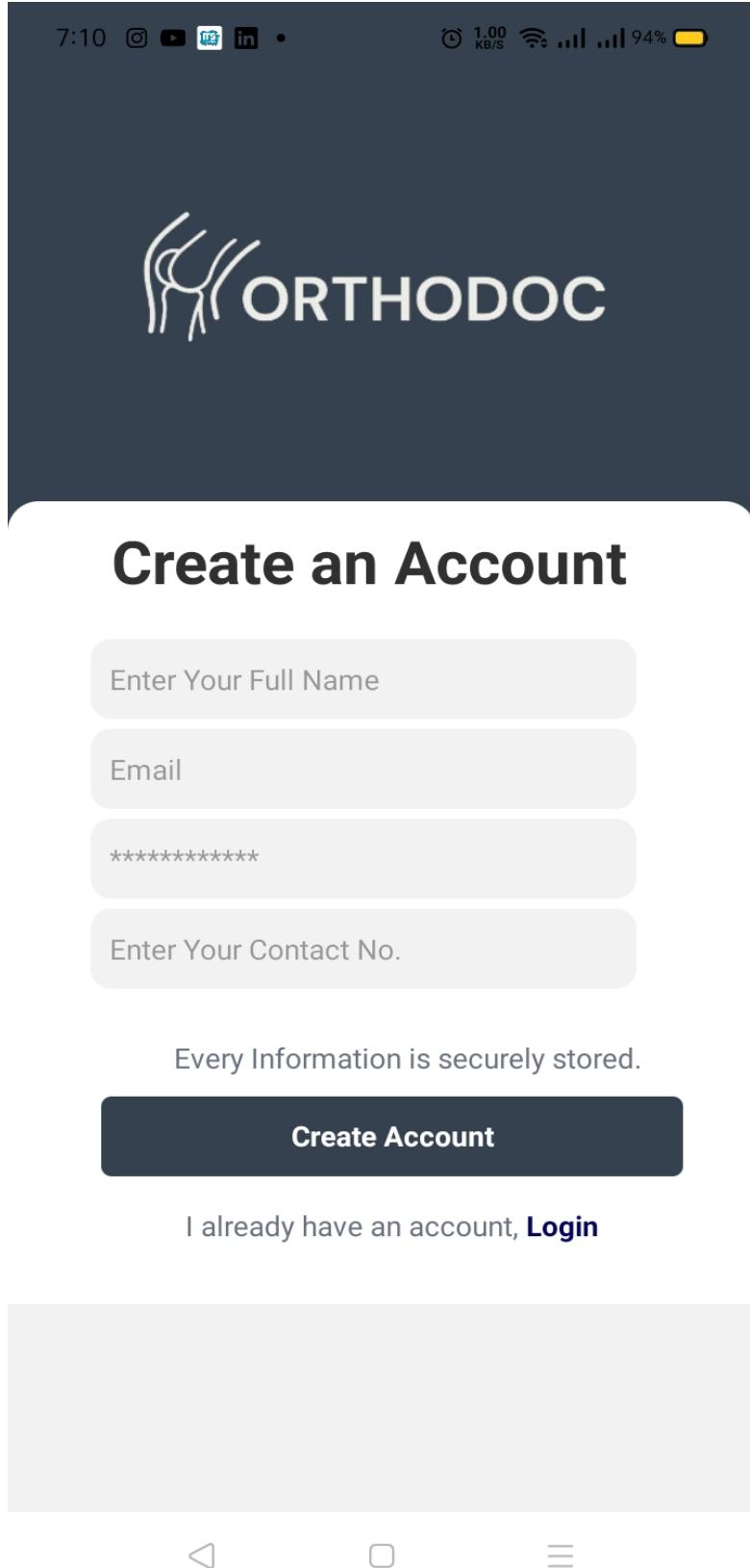
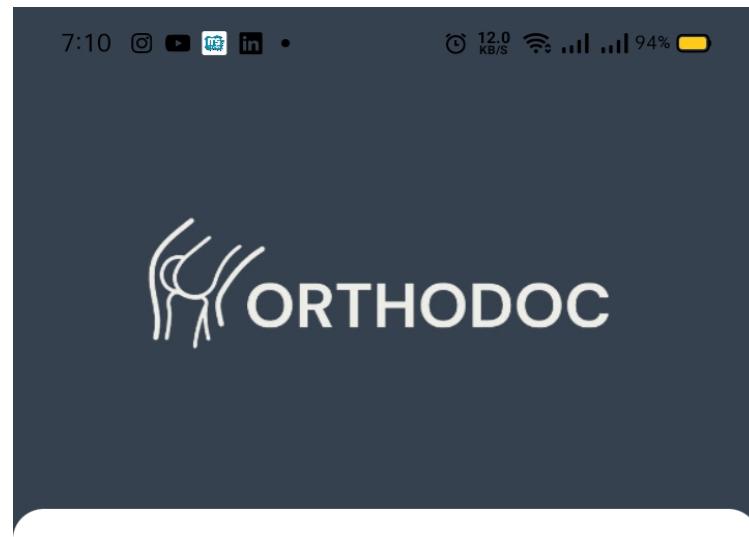


Figure 29: Register



Email:

Enter Email

Password:

Password

[Forgot Password](#)

[Login](#)

I don't have an account, [Sign Up](#)

Figure 30:Login

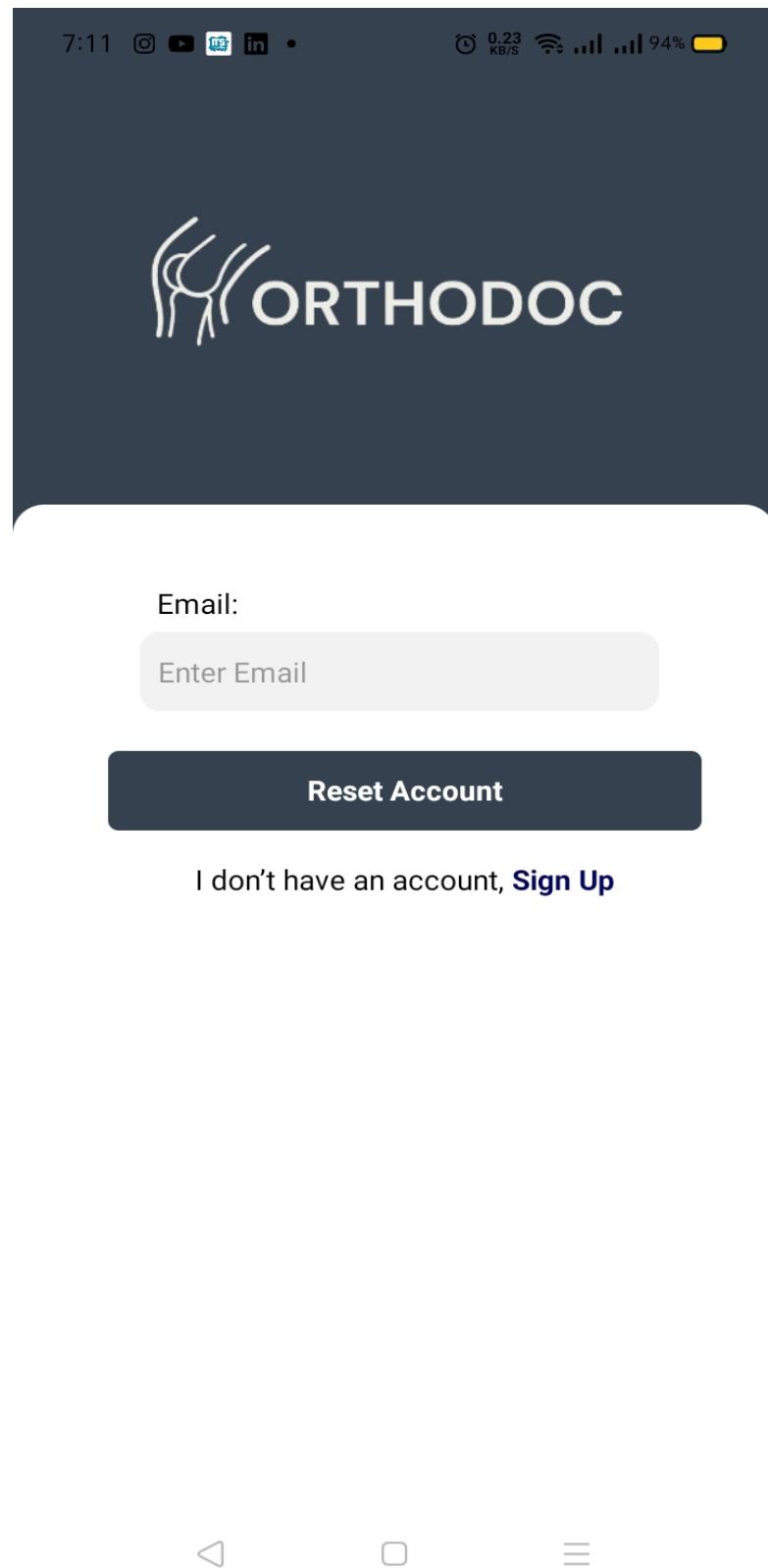


Figure 31:Reset password



Figure 32:Home

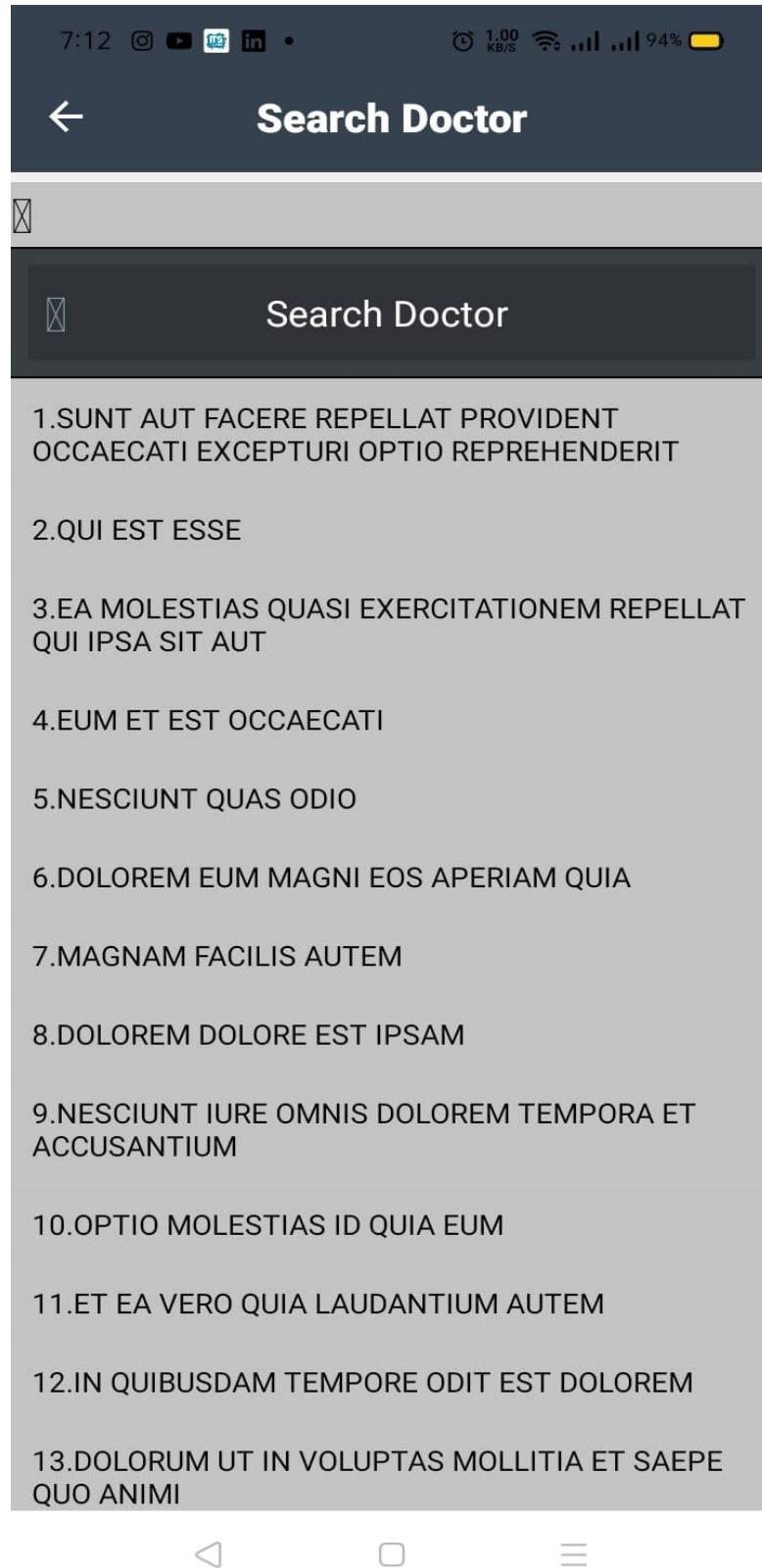


Figure 33:Search for Doctor

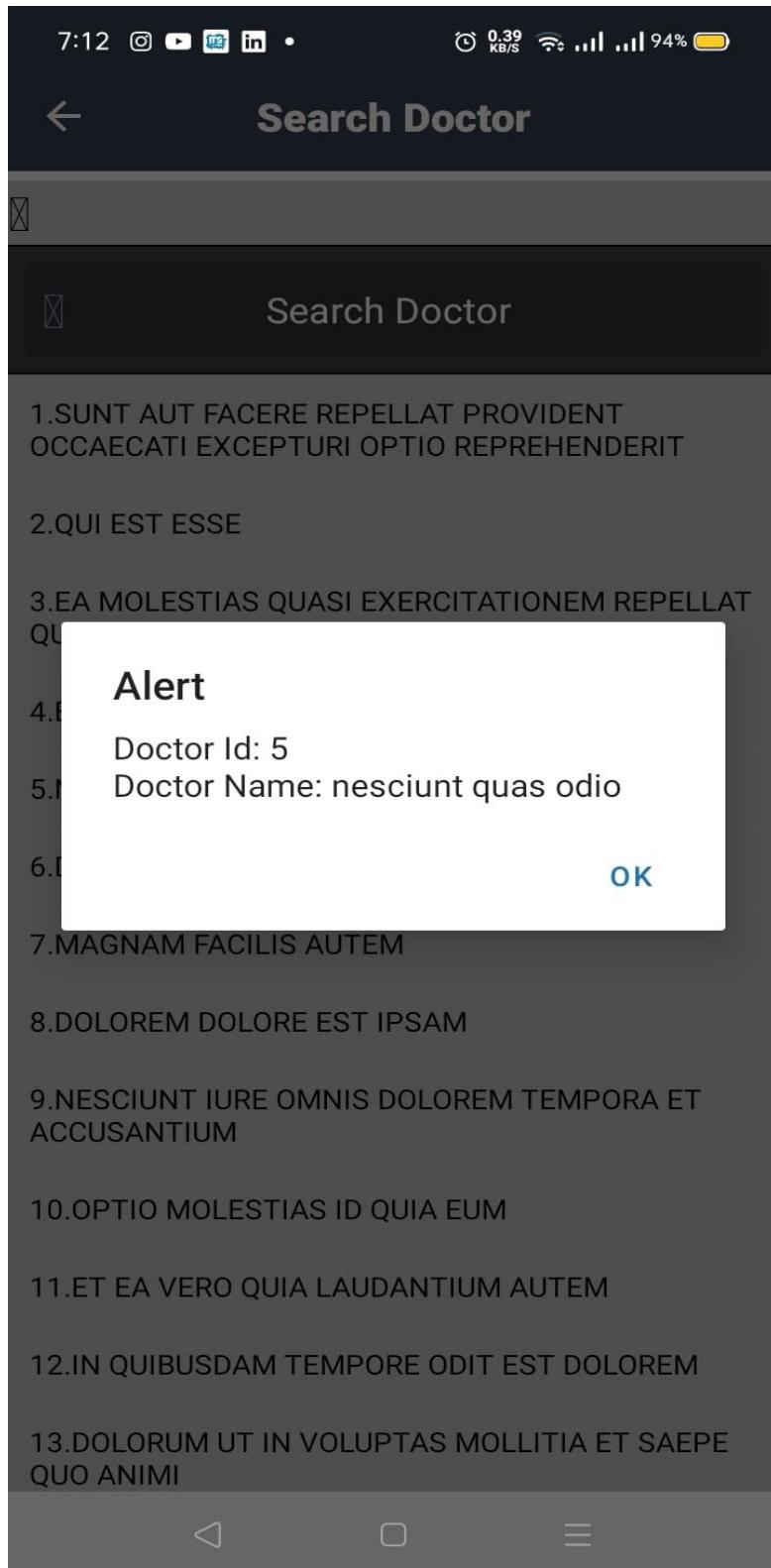


Figure 34: Doctor's Details

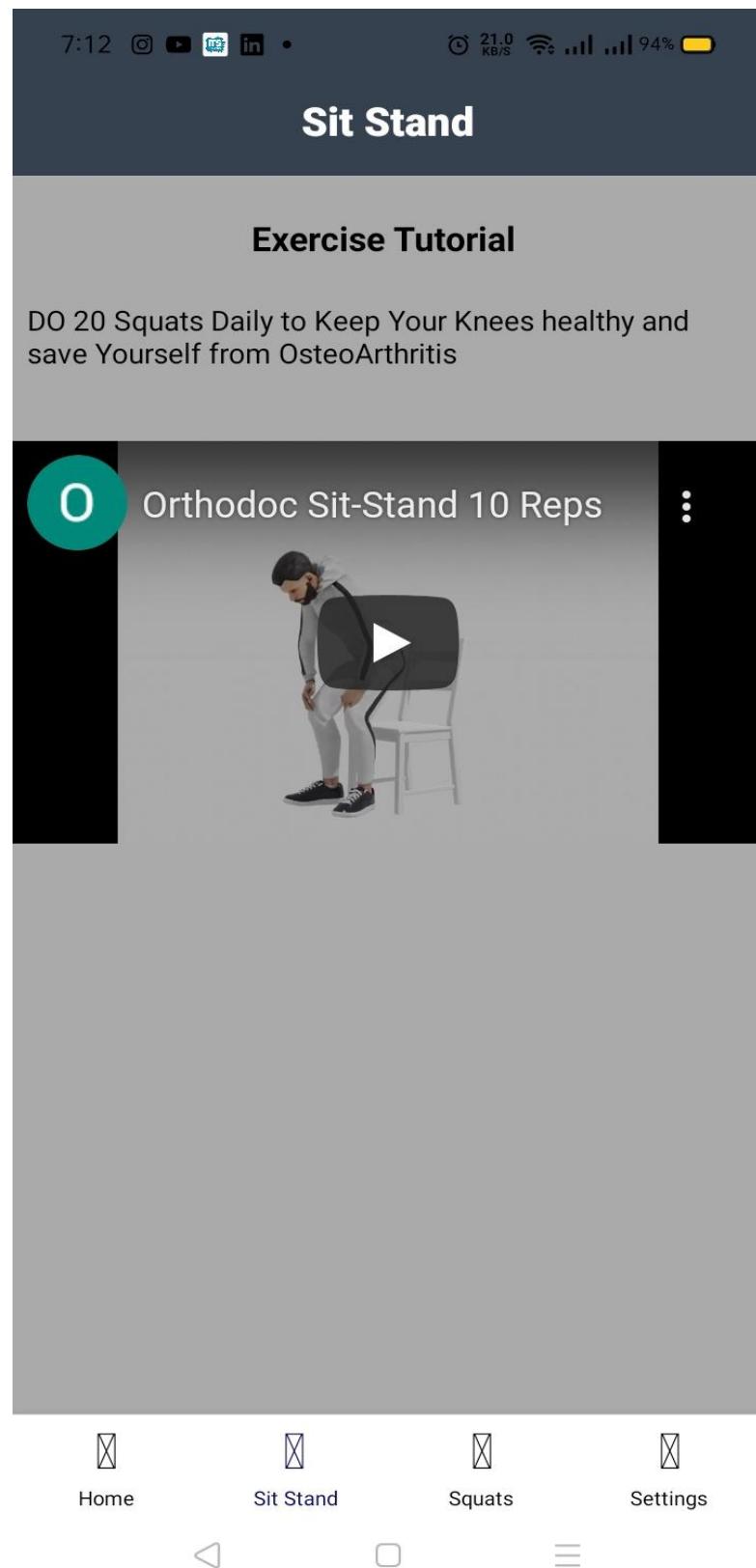


Figure 35:Exercise Animation I

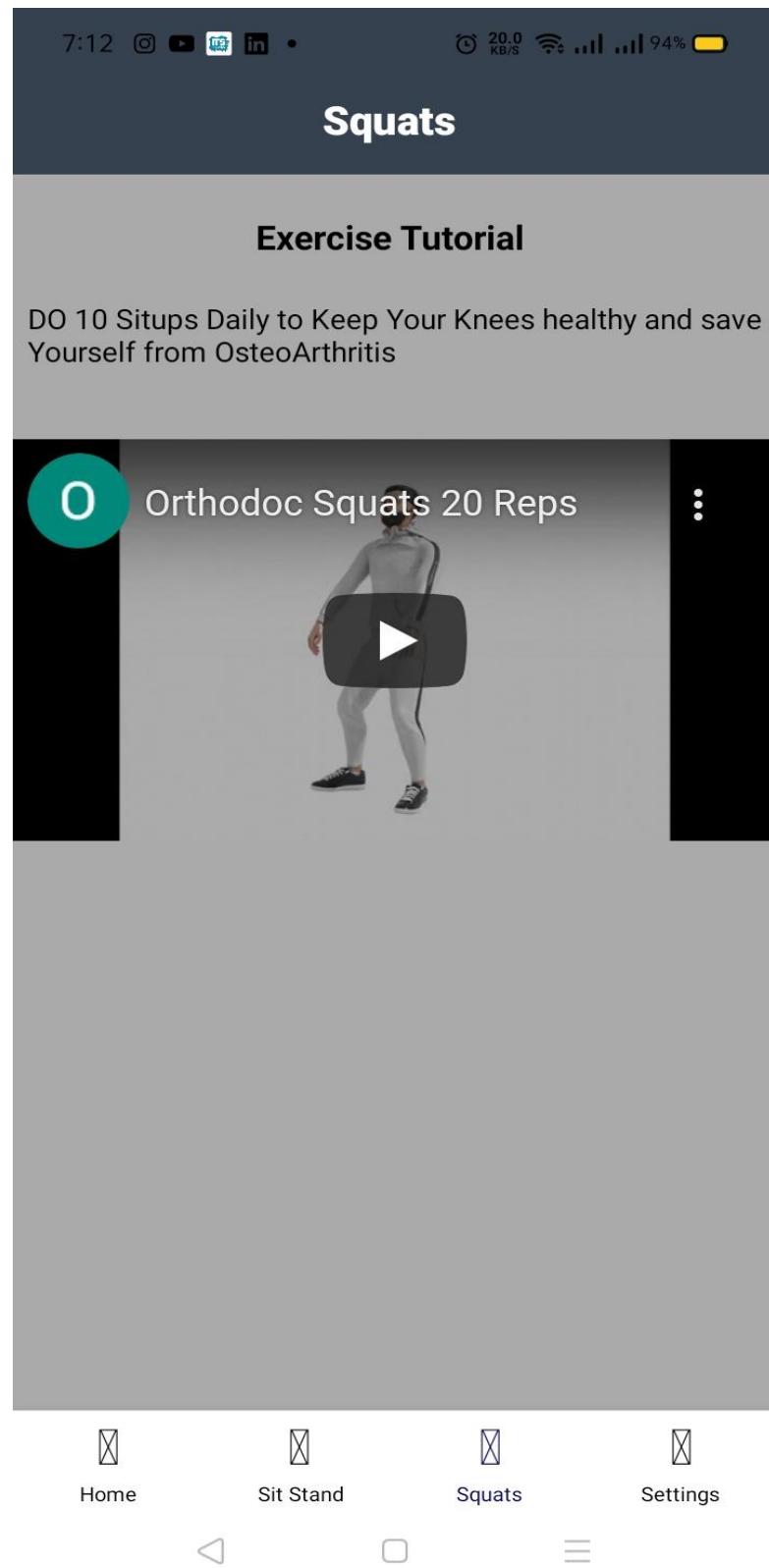


Figure 36:Exercise Animation II

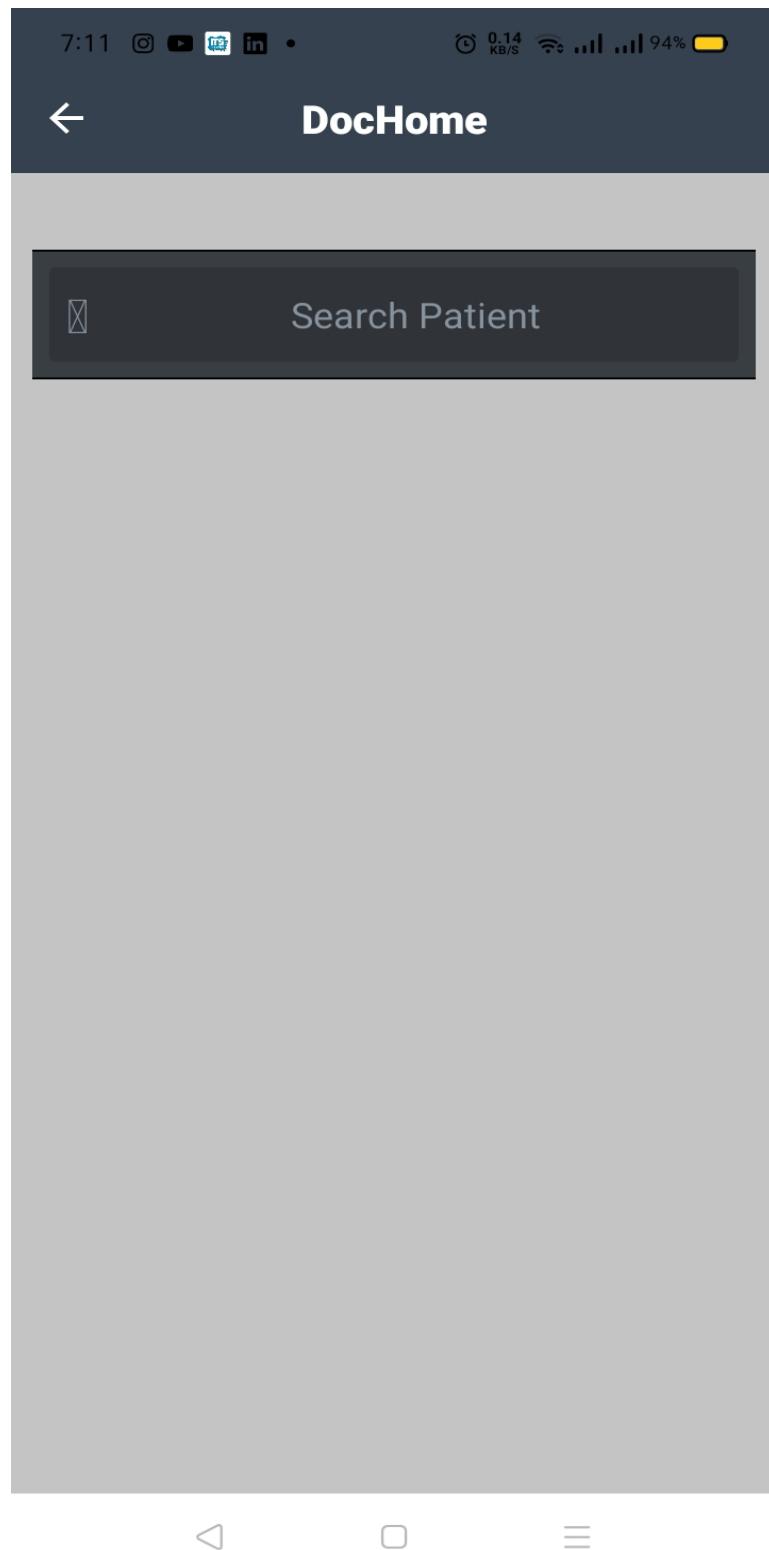


Figure 37:Doctor's Home

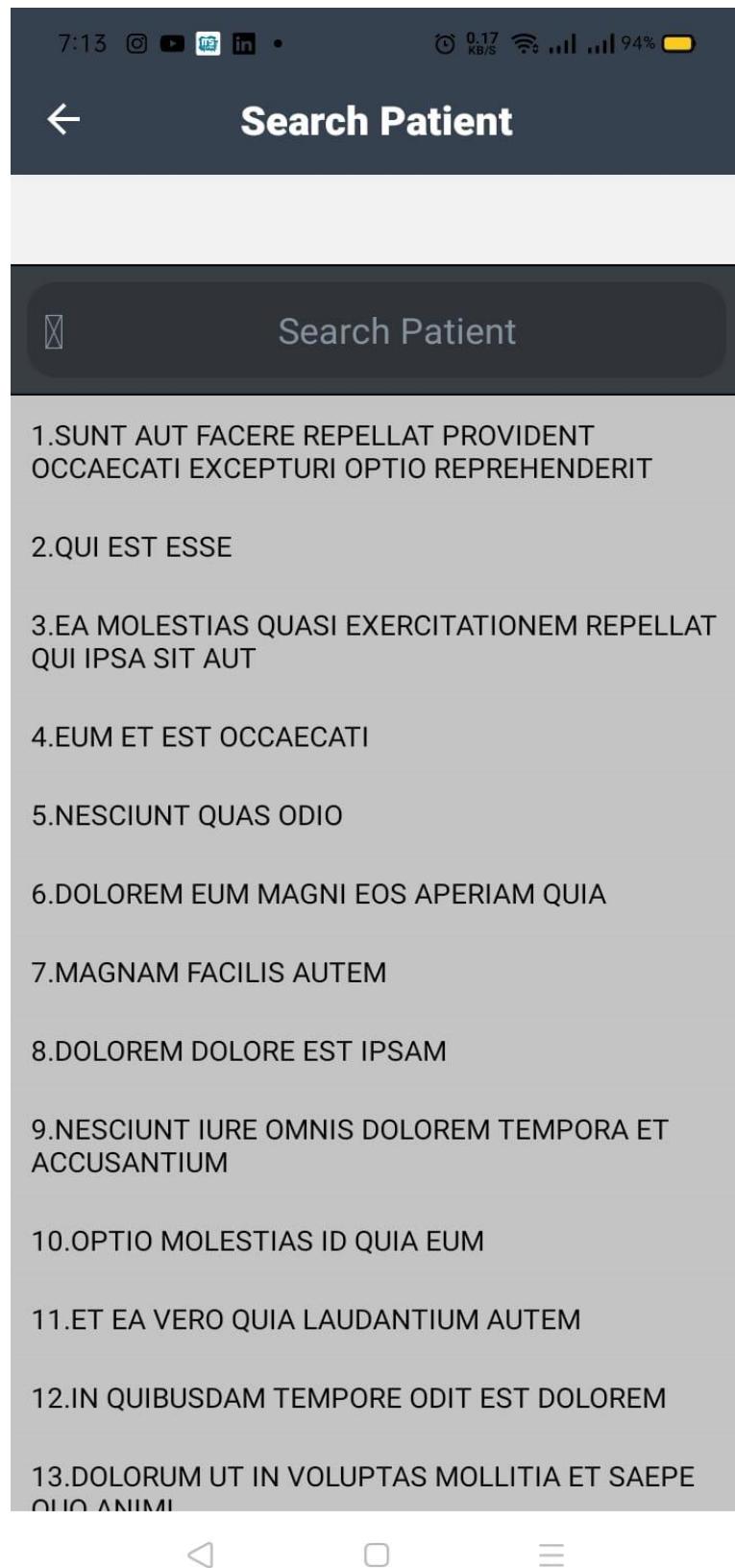


Figure 38:Search Patient

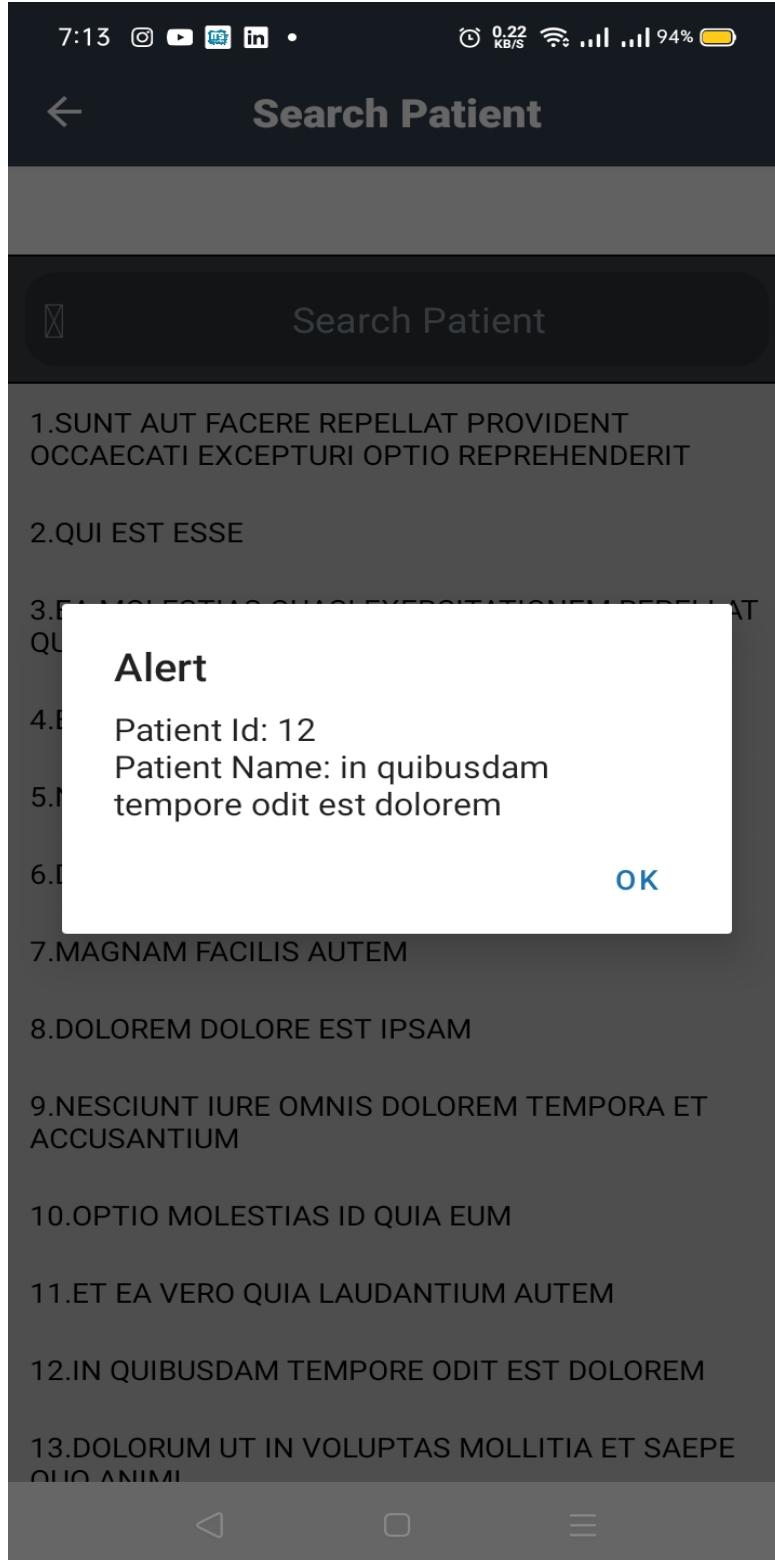


Figure 39:Patient Details

7.2 Screen Objects and Actions

Figure 28: It is the Splash Screen of the application after user is navigated towards home screen.

Figure 29: User enters the data in the fields specified to create an account.

Figure 30: User enters the login credentials and press login button and is navigated to home page.

Figure 31: User can reset password.

Figure 32: Home page for patient.

Figure 33: Patient can search for the doctors.

Figure 34: Doctor's details can be viewed by the patient.

Figure 35: Sit-stand exercise animation for patient.

Figure 36: Squats exercise animation for patient.

Figure 37: Home page for doctor.

Figure 38: Doctor can search for patient.

Figure 39: Patient's details can be viewed by the doctor.

8. Plagiarism Report

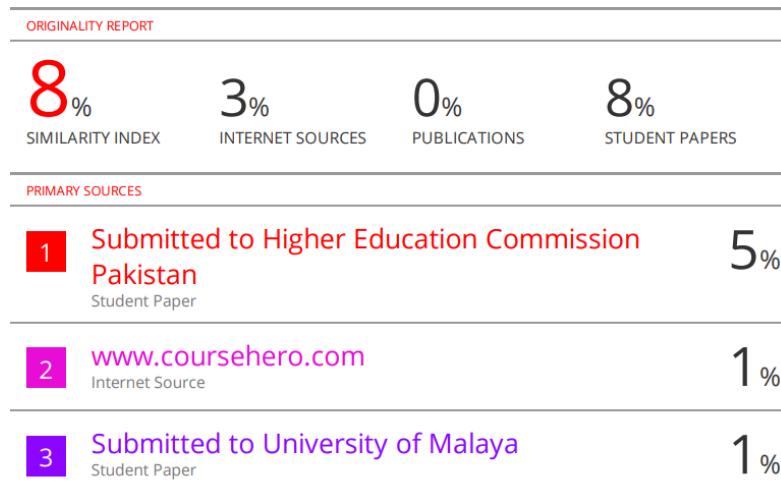


Figure 40:Plagiarism Report