BSCS FINAL PROJECT

Smart e.Pharmacist

Project Advisor
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Presented by:
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Faculty of Information Technology

University of Central Punjab

Complete System

SDP Phase IV

Smart e.Pharmacist

Advisor: Sir Saeed Iqbal Khattak

Group S22BS027

Member Name	Primary Responsibility
Jaweria Tariq	Drug to Drug Interaction, Drug to Food Interaction, Search Medicine, Backend, Phase 4 Documentation
Shahan Javed	Frontend, Backend
Muaaz Kamran	Scan Prescription

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Revision History

Name	Date	Reason For Changes	Version

Abstract

Smart e.Pharmacist is a mobile application that will be used to search for prescriptions or alternatives to medications that a user is currently taking. Patients may take many medicines for the same condition in the misguided notion that this may speed up the healing process, while in fact the Drug-Drug interaction of some prescriptions may cause harm to the patients. Using this app, the user may scan their doctor-prescribed prescription, and the system will determine whether the medication combination is safe to take. The app is divided into two interfaces: one for patients and one for qualified and licensed specialists. Users can look up medications based on their symptoms, consult a doctor, search for any Drug-Drug Interactions, and so on. The Artificial Intelligence model will be trained using the datasets obtained from the DrugBank.

1. Introduction

1.1 Product

Drug-drug interaction (DDI) can cause a variety of negative side effects in patients and has emerged as a hazard to medicine and public health. This occurs when a patient takes many medications for the same condition in the misguided idea that doing so may hasten healing. Then, because the unwanted effects of one drug may be the polar opposite of the intended effects of another, the desired effects are diminished. Patients are often unable to contact doctors to consult about their symptoms or even to inquire about a substitute for the medicine they are presently taking due to a shortage or if they believe the treatment is harming their health rather than benefiting it. Smart e.Pharmacist is a mobile based application that provides it's users a medical assistance using the concepts of Artificial Intelligence and Machine Learning.

1.2 Background

Machine learning is a rapidly growing technology in the health care industry. Artificial intelligence is employed in nearly every aspect of medicine, from research to patient data and risk analysis, from hospital administration to digital health monitoring and diagnostics, and so on. [1]
There are many medicine applications that a user can use to find a medication. Some of them with the similar domain are as follows:

- Pharmapedia Pakistan: General medicine information
- PharamaPlus: General medicine information
- Medscapce: Drug/ Disease information, News and CME
- DrugBook: Provides online doctor services, medication reminder
- Tabiyat.pk: online pharmacy system
- mediQ: online pharmacy, medical equipment system, doctor consultation, hospital services system

Some of the applications described above are used by medical experts to search for medicines, drugs, and pharmaceutical information, among other things. Drug or disease information, medical news and

CME, consulting doctors, arranging appointments, and ordering medicines online are also included in the applications.

The suggested system incorporates many of the goals of the aforementioned applications. Smart e.Pharmacist has a unique function of prescription scanning and an online doctor consultation system. The system will review all of the drugs in the prescription and perform a background check based on the patient's medical history to see if the patient may have any adverse reactions to the medicine combination they are taking. In the event of an unfavorable reaction, the system will also recommend an alternate medication. The application will provide a method for users to consult doctors and medical professionals without having to make appointments or physically visit a doctor.

1.3 Objective(s)/Aim(s)/Target(s)

The mobile application provides a dependable channel for its customers to obtain the appropriate medicine based on their medical history. The system maintains track of the patient's medical history and prescriptions in order to detect any negative drug-drug interactions. Patients can also consult a medical professional in the event of an emergency involving pharmaceutical reactions. Patients can also use the system to look for alternative medicines. An appropriate platform is provided for medical specialists to set up their profiles and attend to patients.

1.4 Scope

The mobile-based Smart e.Pharmacist app allows the patients to search for pharmaceuticals relevant to any symptoms they are experiencing, upload their prescriptions into the system, and verify whether the medicine/s they are taking are safe to ingest in their condition, as well as substitute treatments. Users can also consult an expert if they are experiencing particular symptoms.

Smart e.Pharmacist has two user interfaces: one for patients and one for credentialed specialists. This programme has two user levels:

- Patients
- Pharmacist/Doctors

The scope of the patients is:

- **Logging in / signing up** for the patient interface of the system using their username and password

- **Entering their personal information**: Patients are required to fill out a form with their personal information. It will be saved in the database. Personal information about the patient comprises their name, e-mail address, medical record, username, and password.
- **Modifying their personal information**: Patients can also update their personal information if required.
- **Scanning their prescription:** Patients can scan their medical prescriptions to see whether the medication combinations they are taking are safe to ingest and how they should be used.
- **Check alternative medicines:** Patients can check alternates of a medicine that they are consuming
- **Drug to Drug Interaction:** Patients can check the drug interaction of the medicines they are consuming
- **Drug to Food Interaction:** Patients can check interaction between a food constituent and a drug
- **Consult Doctors**: Patients can consult with qualified online professionals about any symptoms they are experiencing.

The scope of the specialist is:

- **Logging in / signing up** for the specialist interface using their username and password
- **Entering their information**: Doctors and pharmacists can create profiles with their name, contact information, e-mail address, employment, and field of specialty, practice details, and username. It'll be saved in the database.
- **Modifying their personal information**: Specialists can also update their personal information
- **Searching for medications:** Doctors can search for medicines and alternative medications
- **Consult other specialist:** Doctors and pharmacists can also consult with other professionals about a patient's symptoms or pharmaceutical side effects.

1.5 Business Goals

- Medication awareness
- Self-explanatory application
- Collection of important data
- Create a user friendly and direct interface

1.6 Document Conventions

Times New Roman font was used throughout the documentation of this SRS, and online sources were referenced using italicized characters.

1.7 Miscellaneous

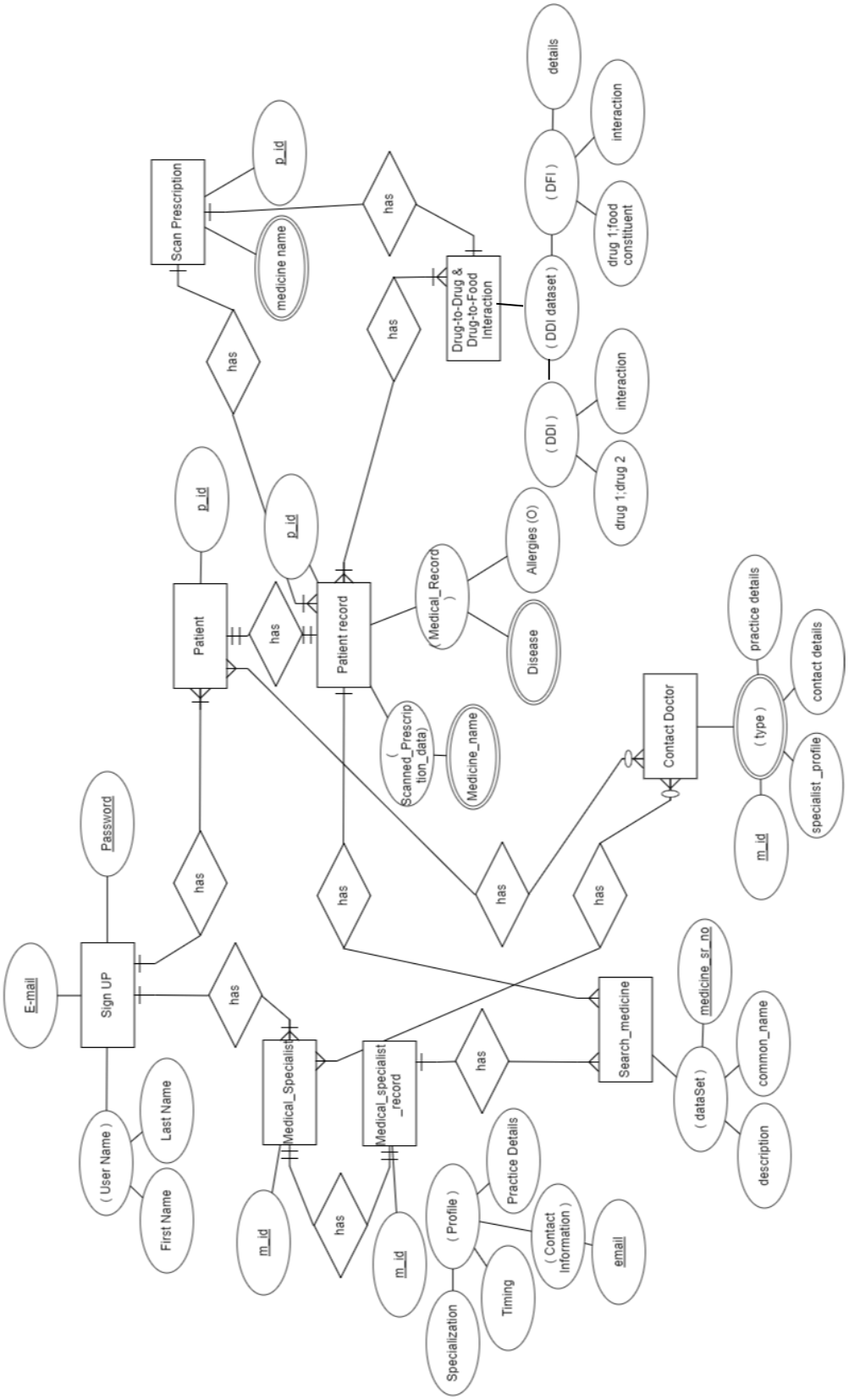
There is no additional information to be provided.

2. Technical Architecture

The suggested system's main components include checking doctor-prescribed prescriptions to see whether there are any undesirable drug-drug interactions as a result of certain pharmaceutical combination. It also provides patients with an online platform via which they may consult a field specialist without having to schedule appointments and physically see a medical professional. The system is designed to collect the user's data, such as patients' medical records, as well as handle the prescription data that the user uploads. The machine learning models are trained using the Python programming language during the application's development phase. Scikit-learn includes core machine learning methods like as classification and regression, which is used to train the drug model. Smart e.Pharmacist is a mobile based application that operates on Android version 8 or higher. The user will require internet connection to access the services provided by the application. Google’s open-source technology, React native, is used to build the mobile application prototype and Node.js is used for backend creation.

2.1 Application and Data Architecture

2.1.1 ER Diagram



2.2 Component Interactions and Collaborations

2.2.1 Design Level Sequence Diagram (Patients)

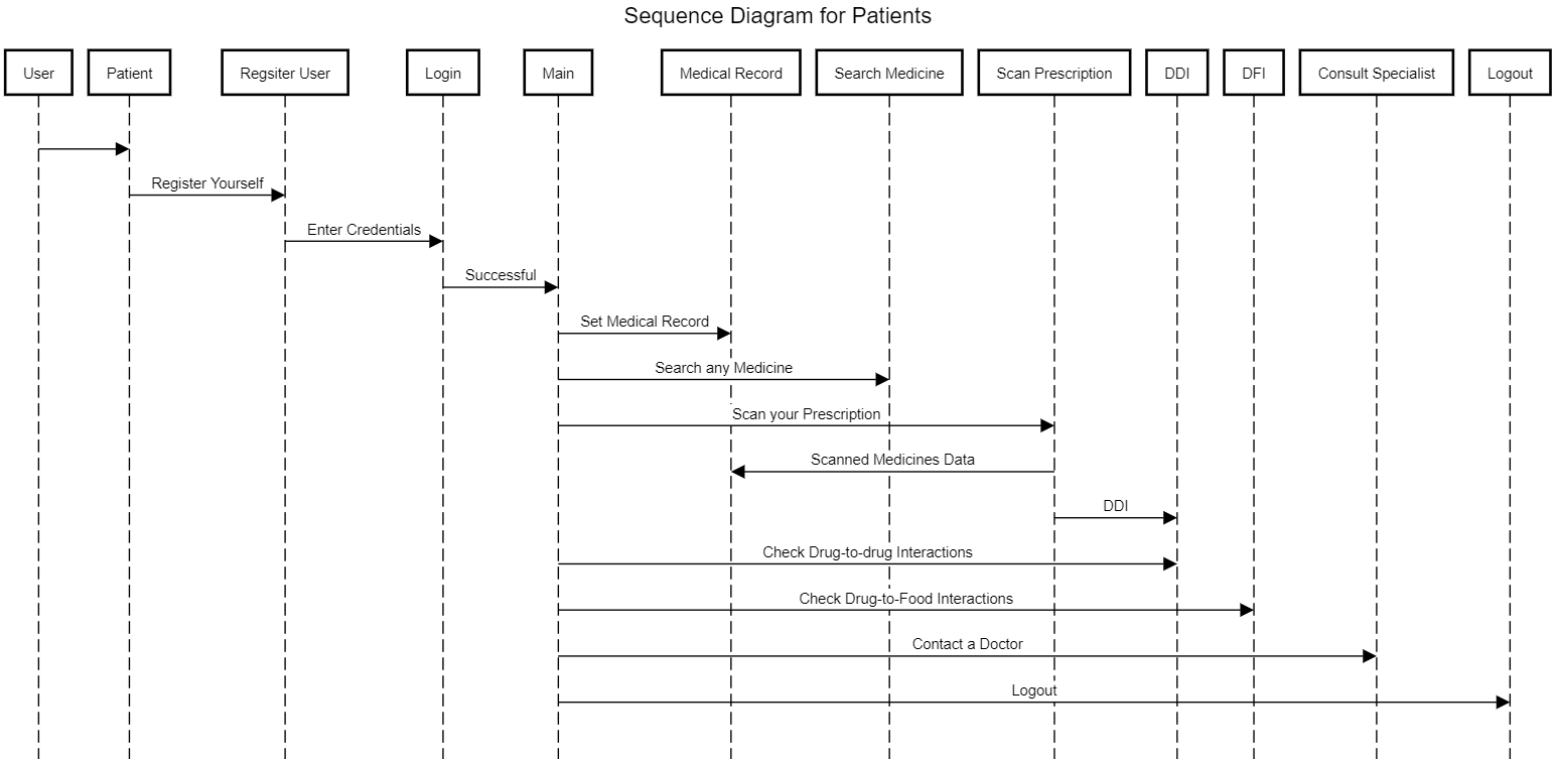


Fig: 2 Sequence Diagram for Patients

2.2.2 Design Level Sequence Diagram (Specialists)

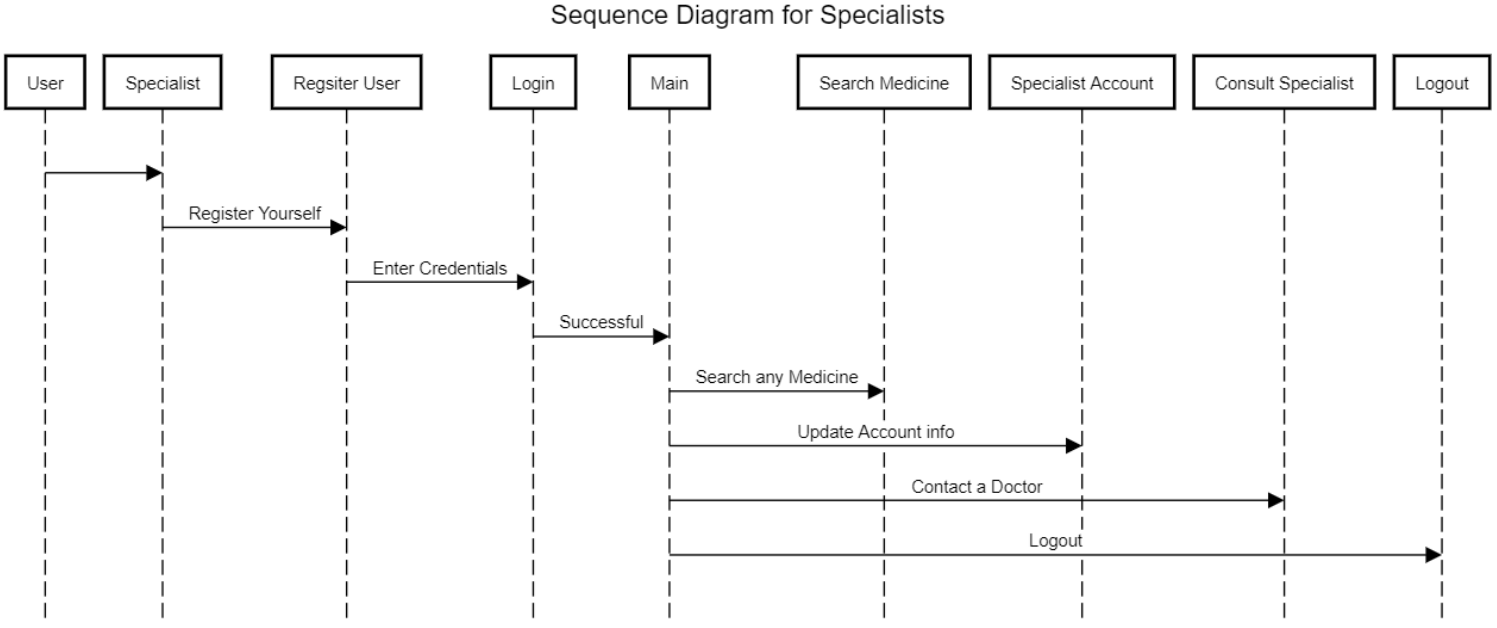


Fig: 3 Sequence Diagram for Specialists

2.2.3 Detailed DFD

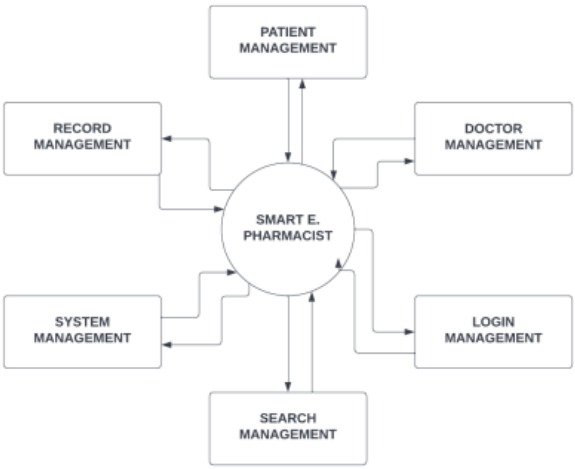


Fig: 4 DFD

2.2.4 Activity Diagram

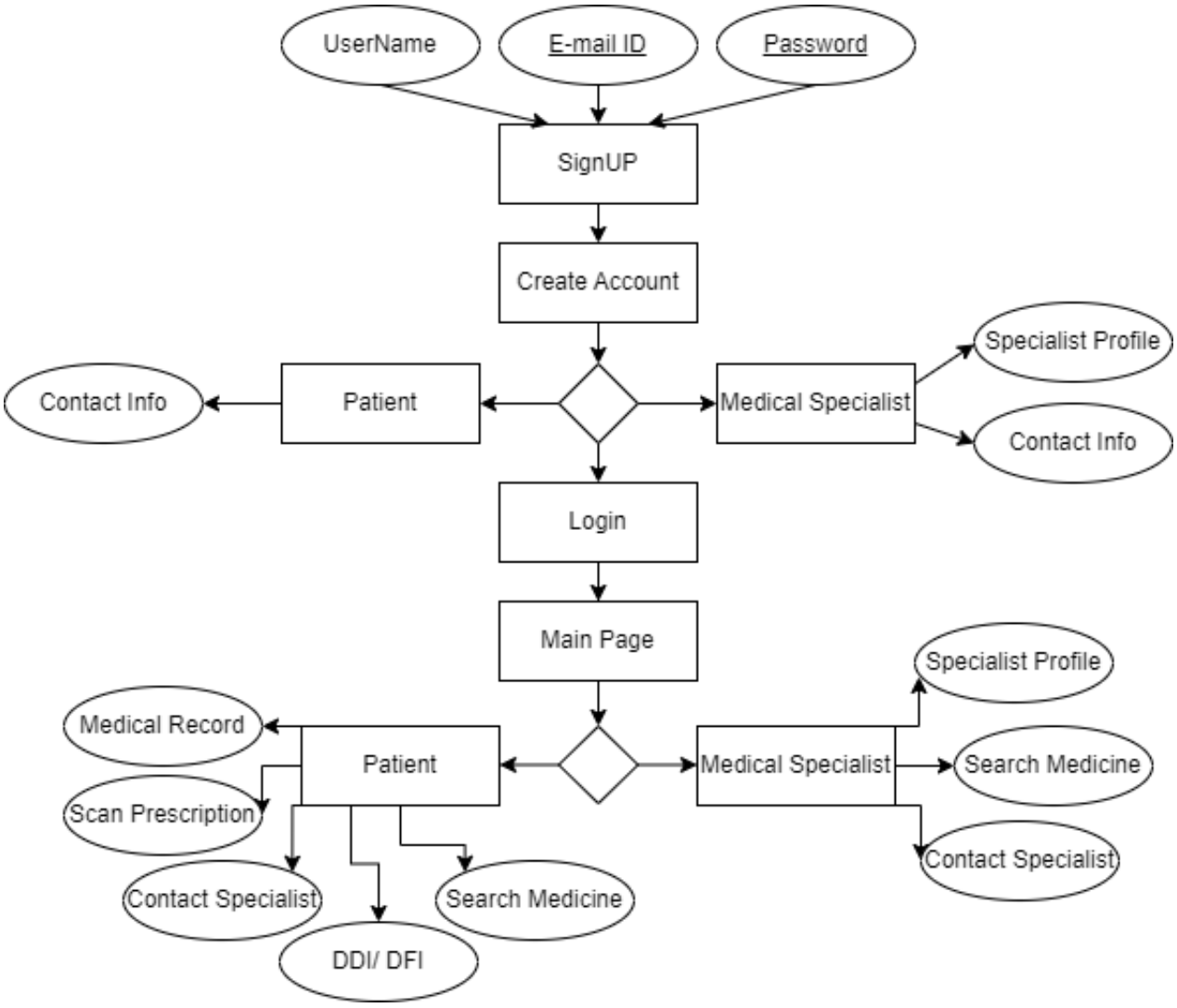


Fig: 5 Activity Diagram

2.2.5 Collaboration Diagram

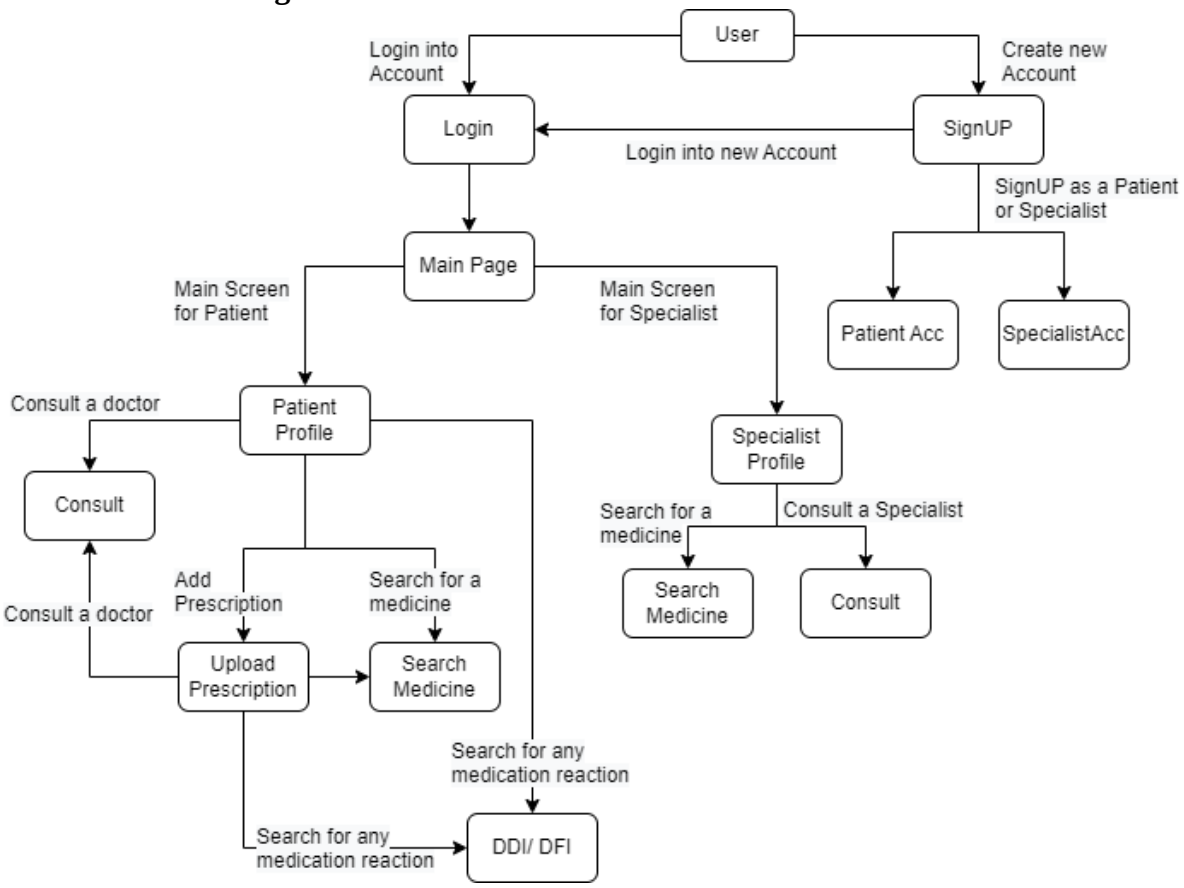


Fig: 6 Collaboration Diagram

2.3 Design Reuse and Design Patterns

There is no Design Reuse.

2.4 Technology Architecture

The architecture is designed to allow users to evaluate the services provided by the proposed system using a mobile phone with Android 10+. It's a thin client-server architecture that's been employed. When a user performs an action, the information shown on the screen is the result of all the background processing. The system will be hosted using an active internet connection on both sides. Users would need a mobile phone with the Smart e.Pharmacist application installed. Because the servers would be subjected to significant stress on a regular basis, they would require a higher configuration.

2.5 Architecture Evaluation

The machine learning models are trained using Python programming language. Python provides a wide range of tools and frameworks that make programming simple. NumPy is used for scientific calculations; SciPy is used for more complex computations; and scikit is used for learning data mining

and data analysis. Python features are easy-to-understand and intuitive syntax. The application prototype is built with ReactNative. It offers a simple, efficient, and responsive user experience while lowering load time significantly. Building apps in ReactNative is also considerably faster and less expensive. Because it is an open-source and community-driven framework, help is readily available online. A recommended framework alongside ReactNative is Node.js's backend. Its capabilities are extensive and strong, making a backend build less difficult to develop. It is one of the most straightforward server-side languages and is easy to integrate with database using Mongodb.

3. Detailed/Component Design

3.1 Class Diagram

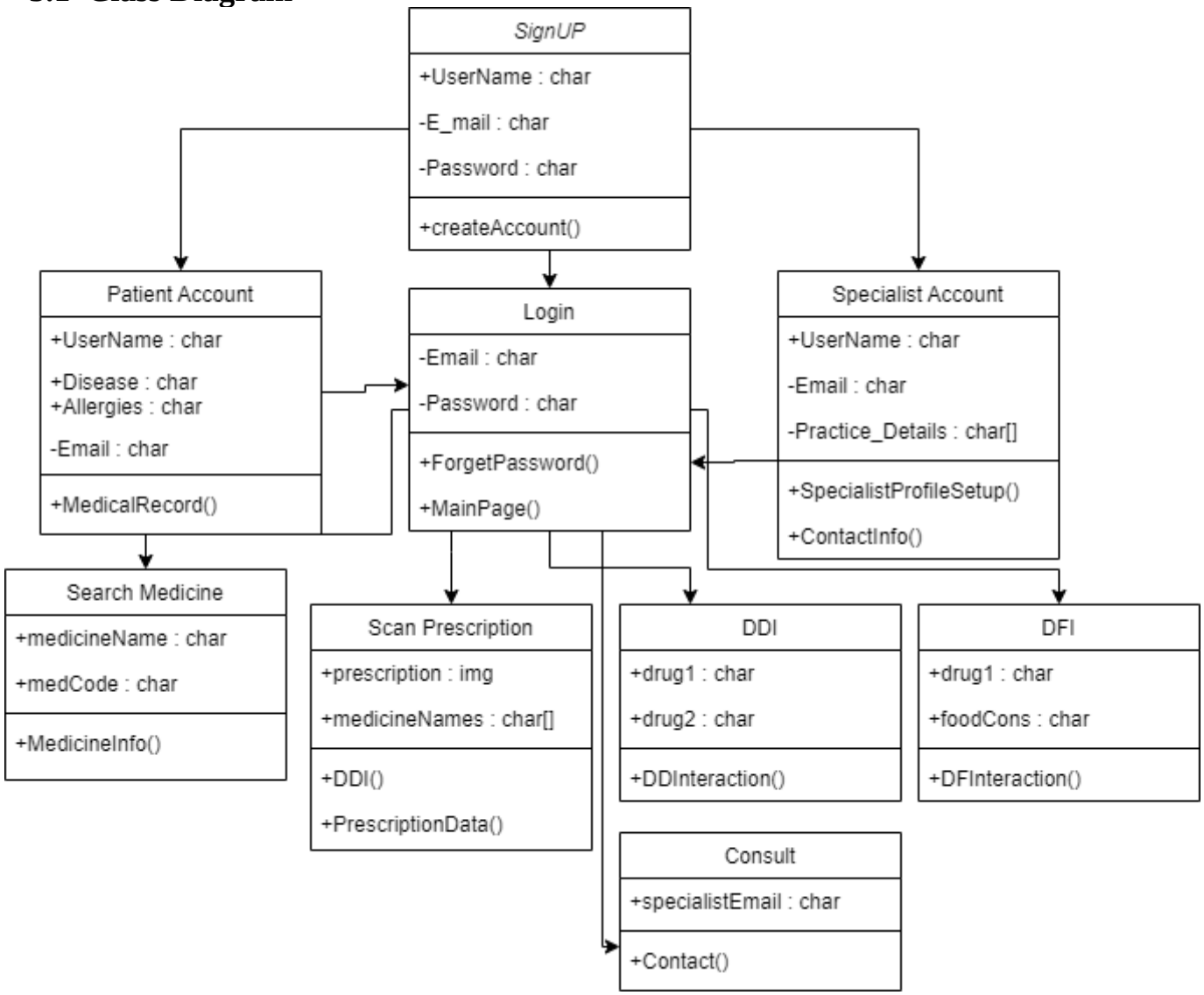
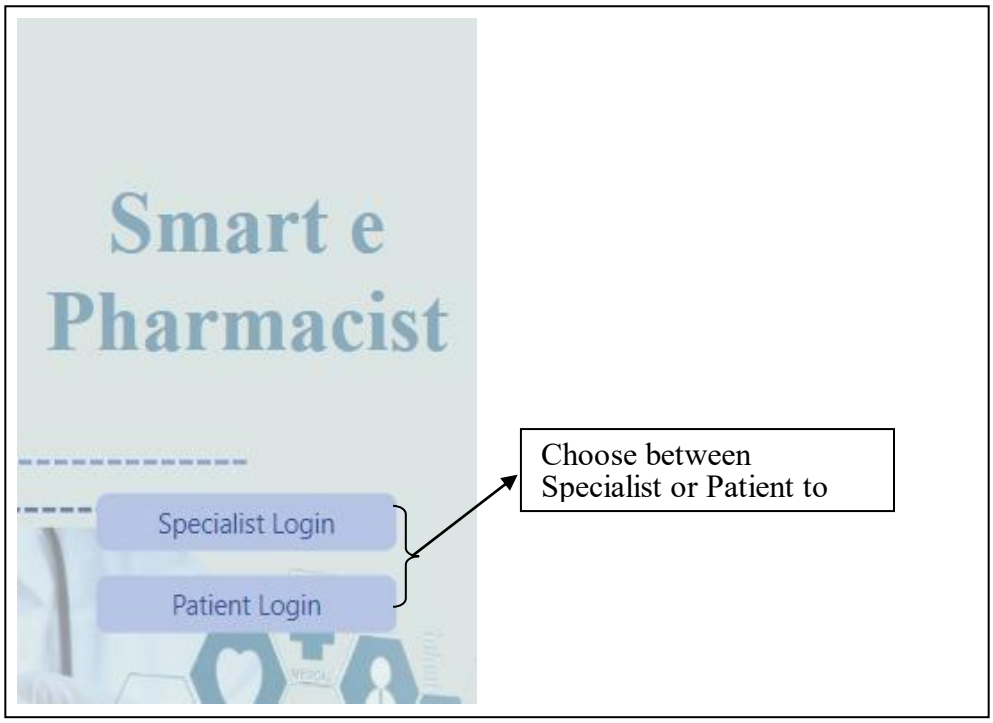


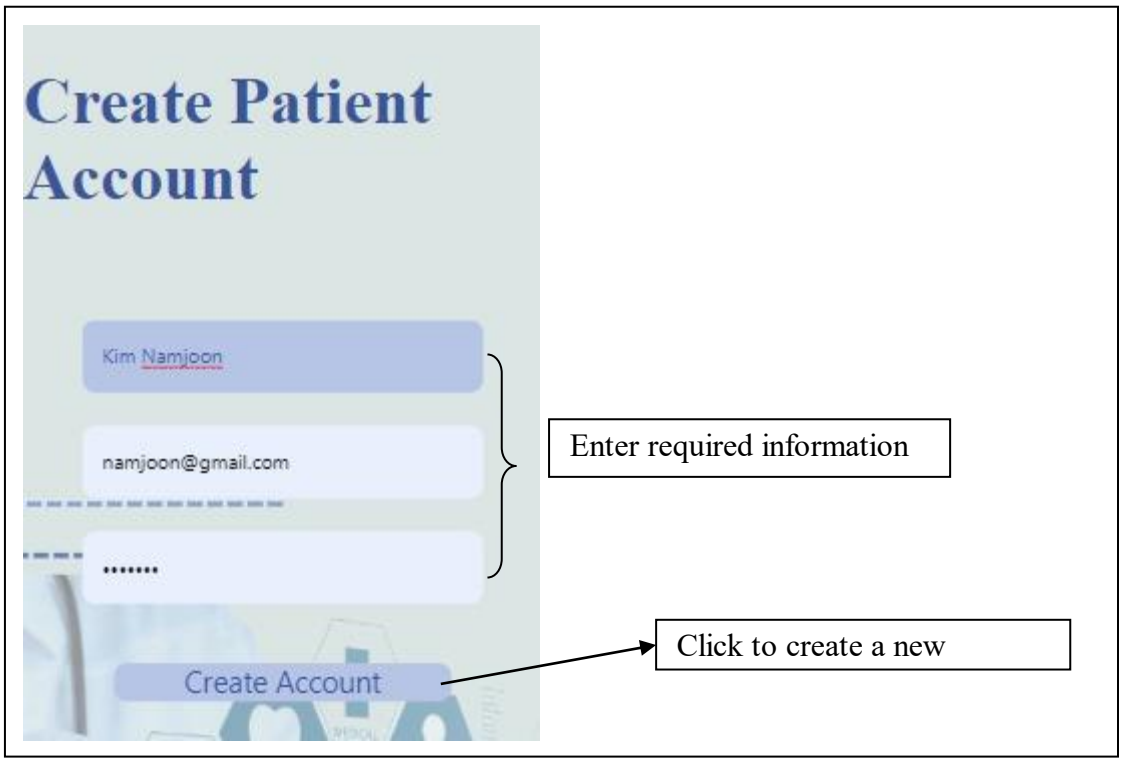
Fig: 7 Class Diagram

3.2 Component-Human Interface

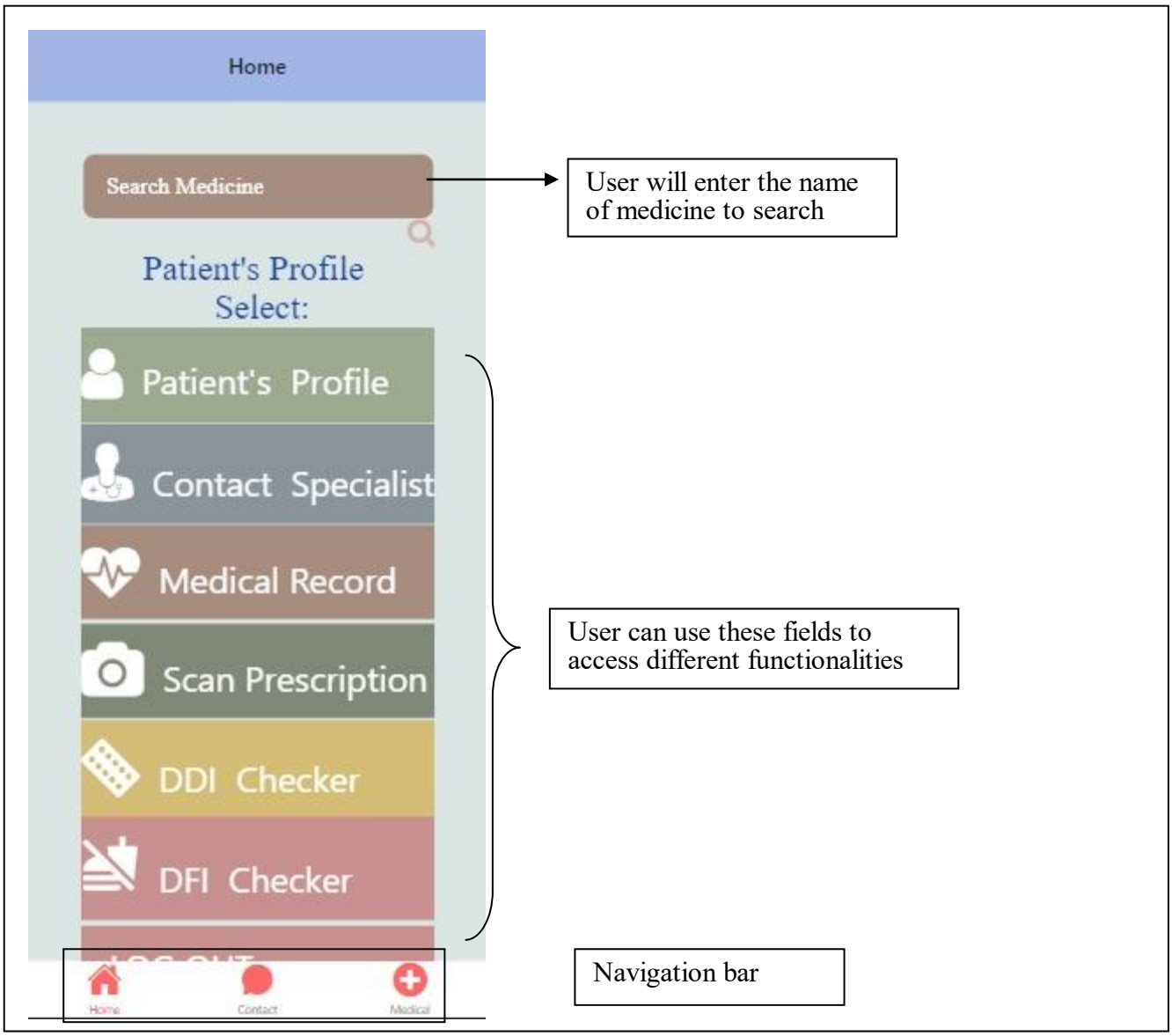
3.2.1 Main Screen



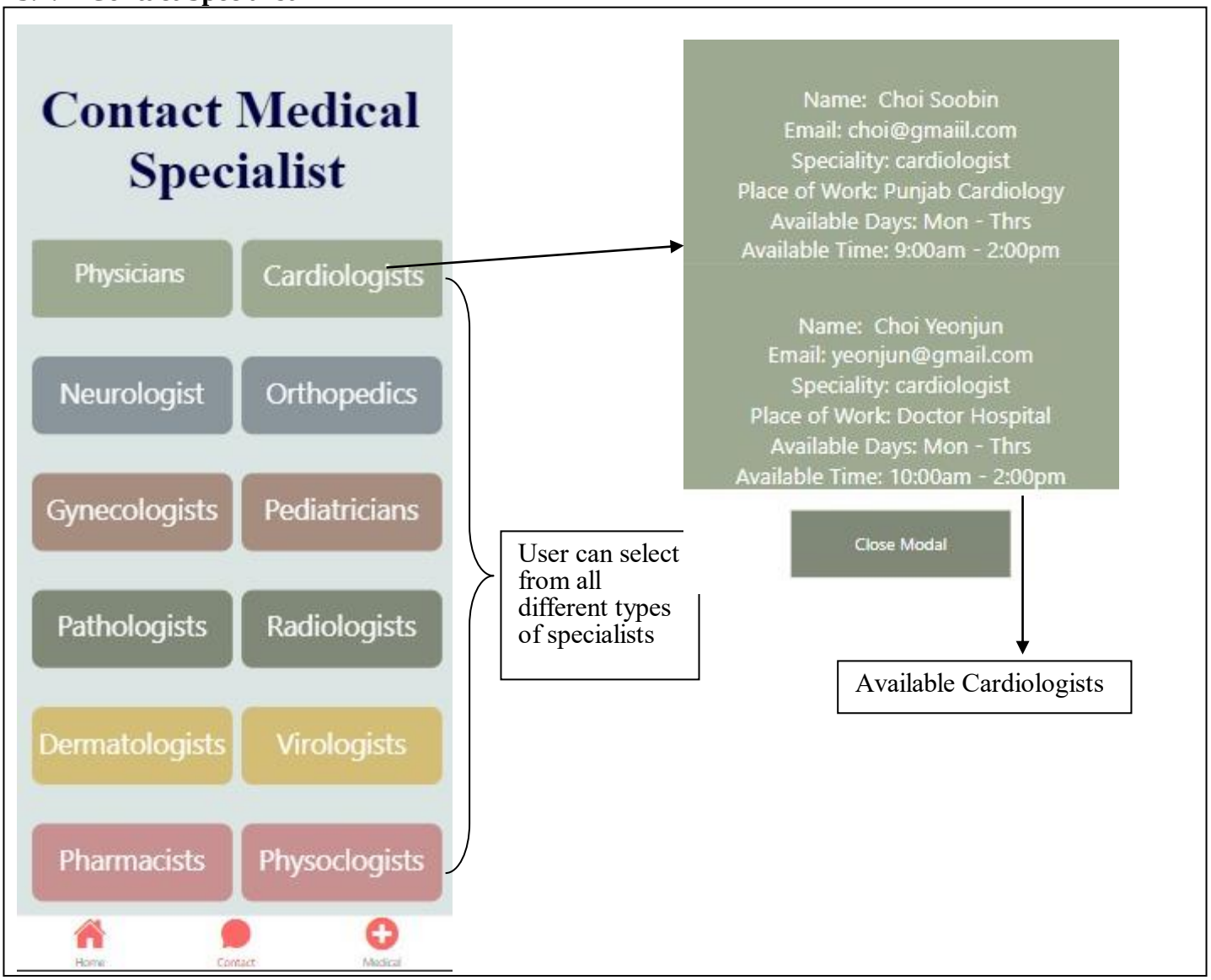
3.2.2 Account Creation



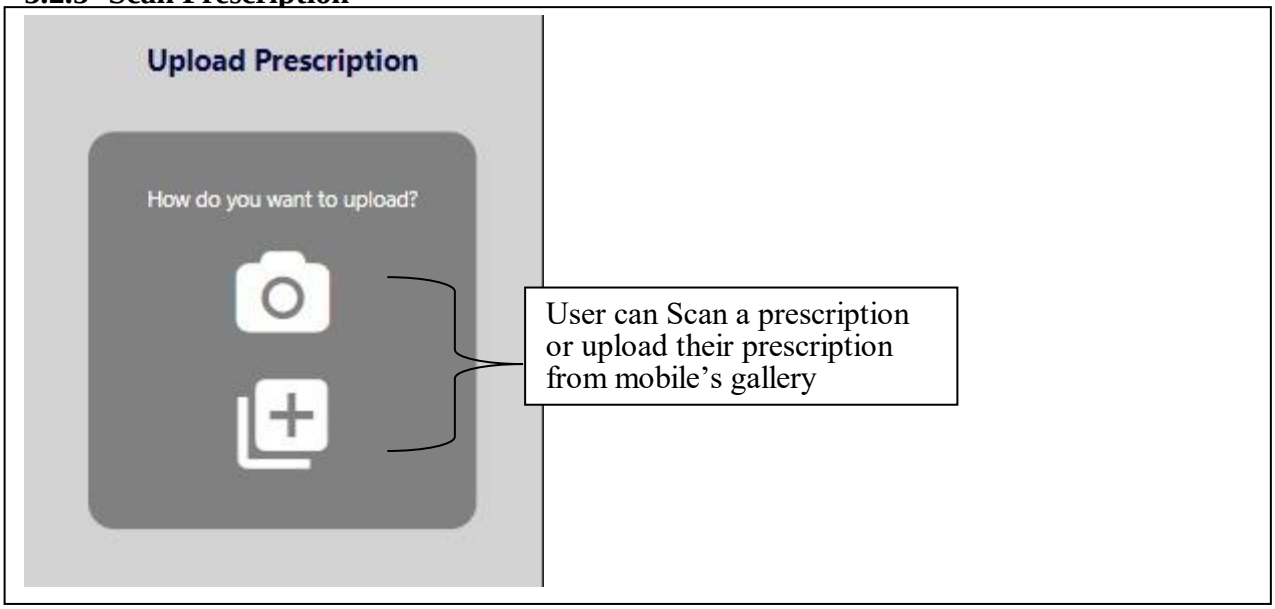
3.2.3 Patient Home Screen



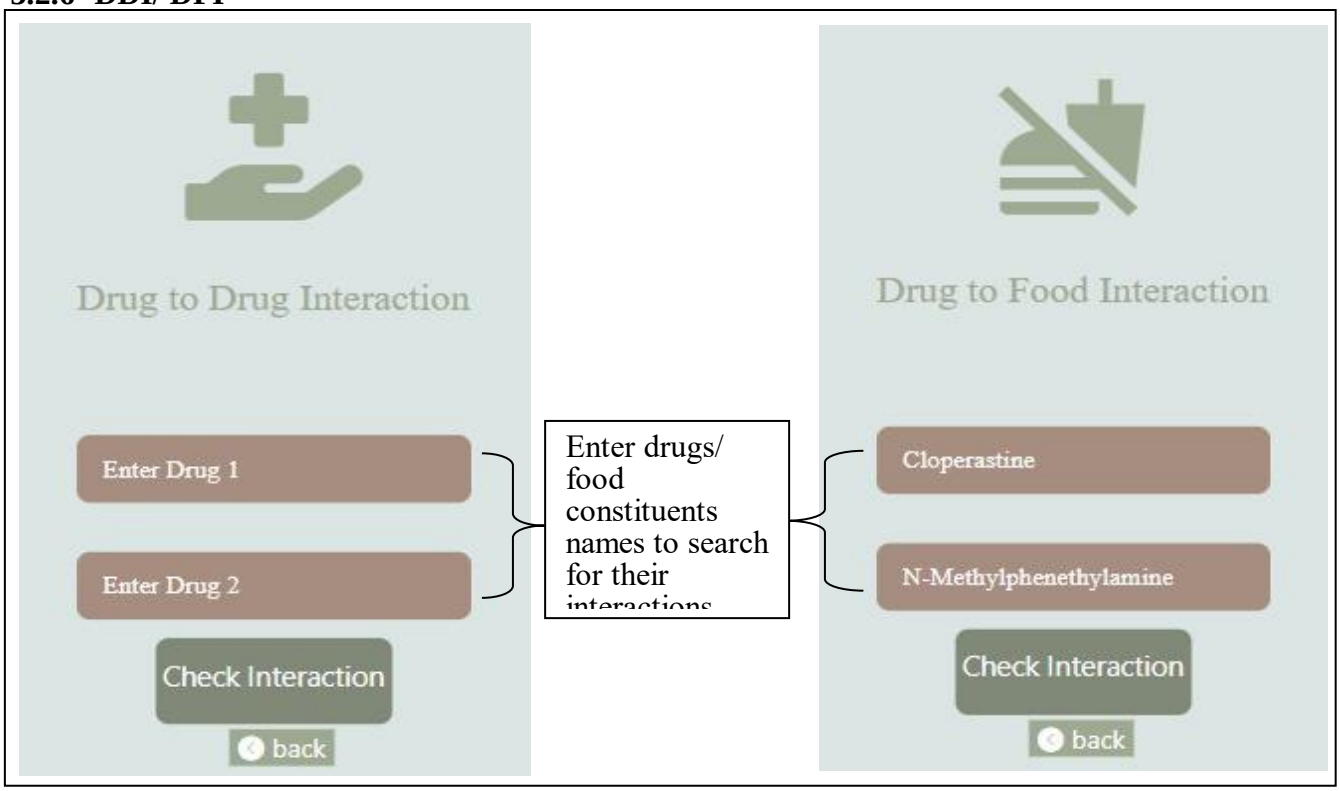
3.2.4 Contact Specialist



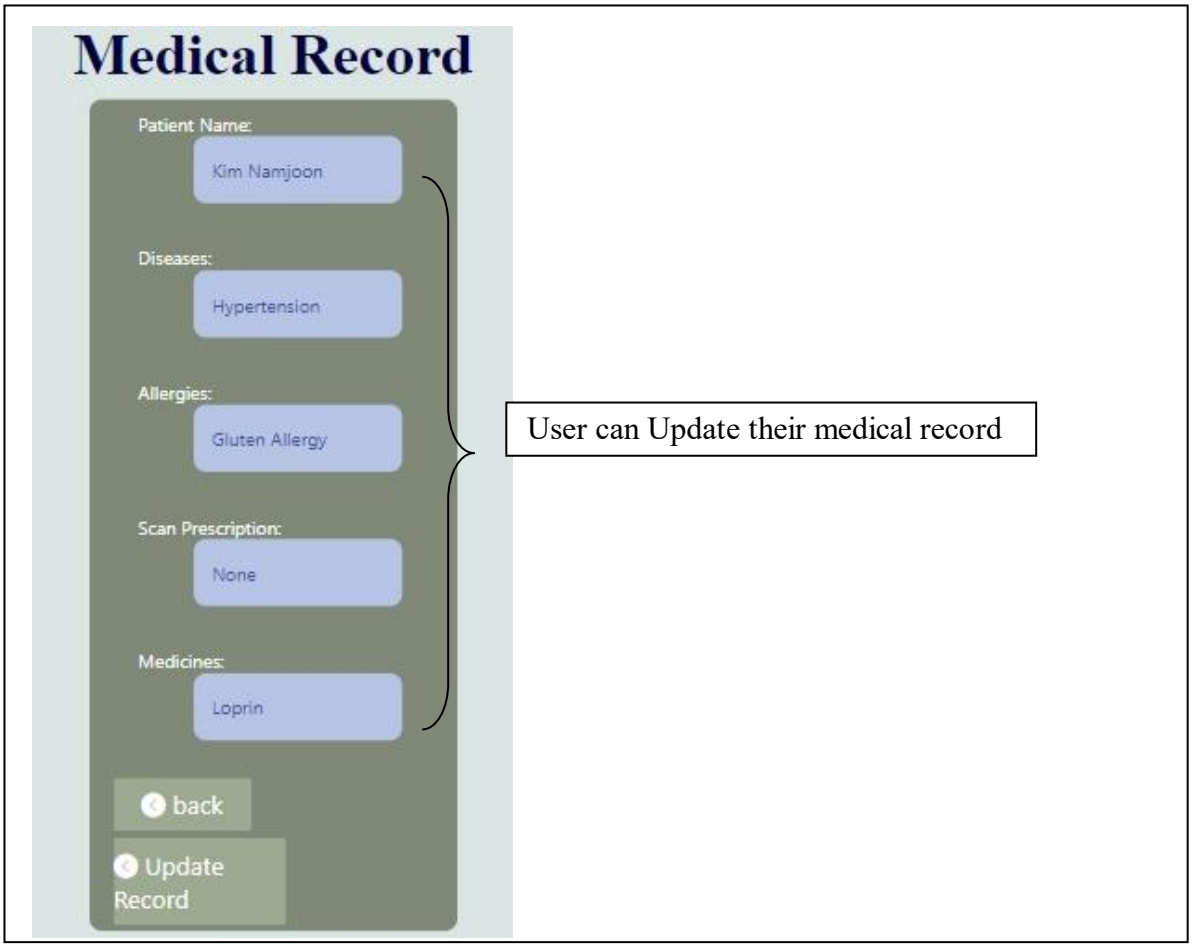
3.2.5 Scan Prescription



3.2.6 DDI/ DFI



3.2.7 Medical Record



4. Screenshots/Prototype

4.1 Workflow

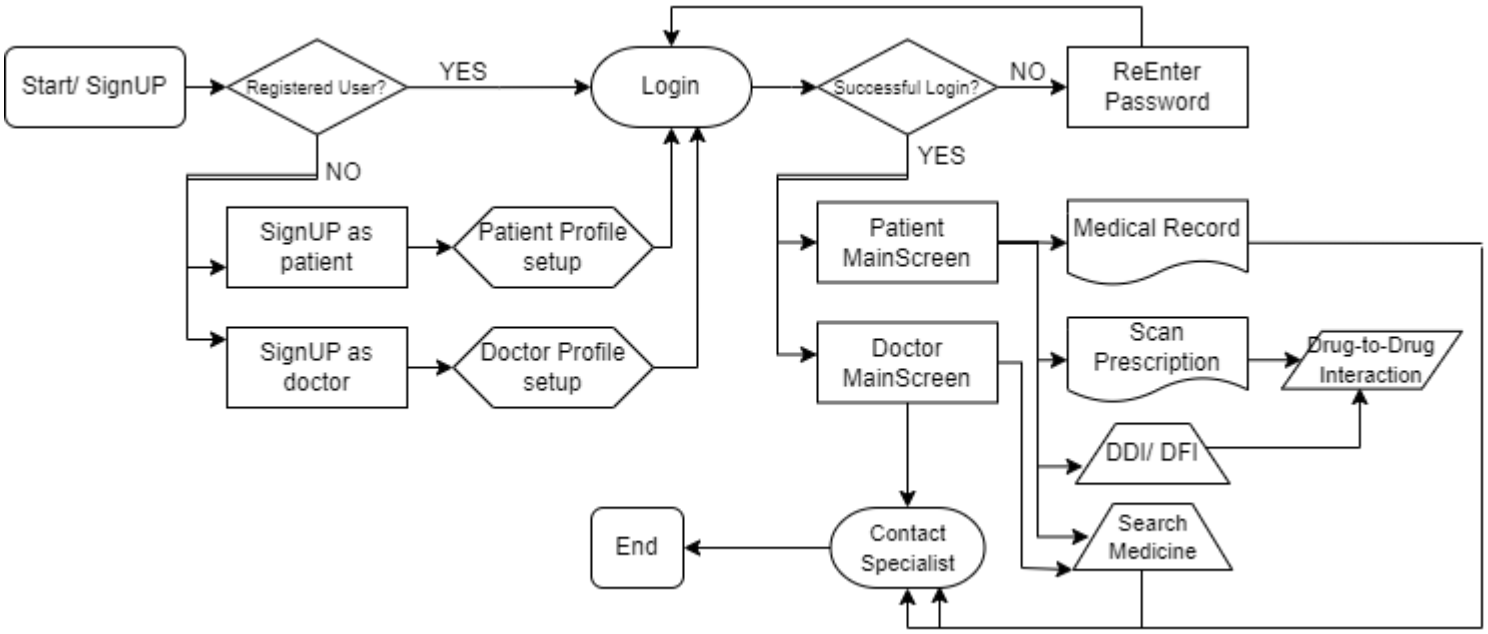


Fig: 8 Workflow diagram

4.2 Screens

Fig: 9 Main Screen

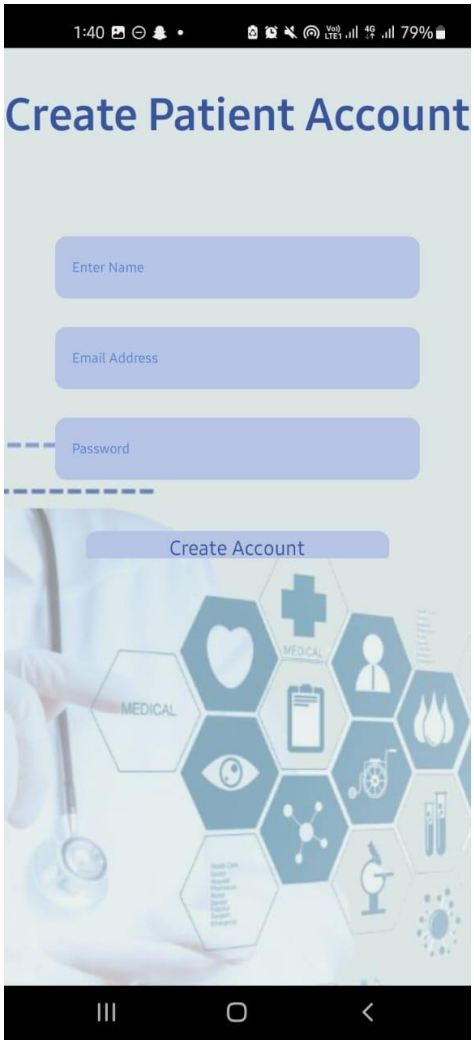


Fig: 10 Patient SignUP

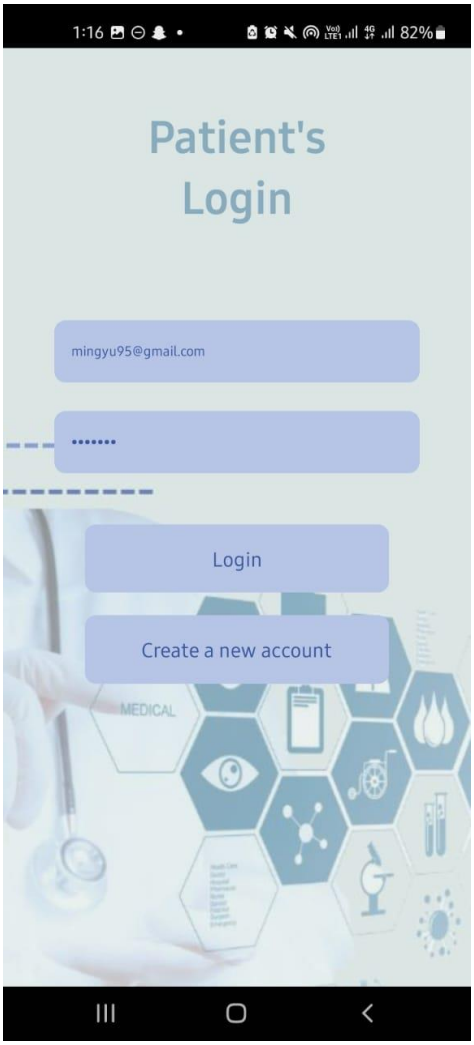


Fig: 11 Patient Login

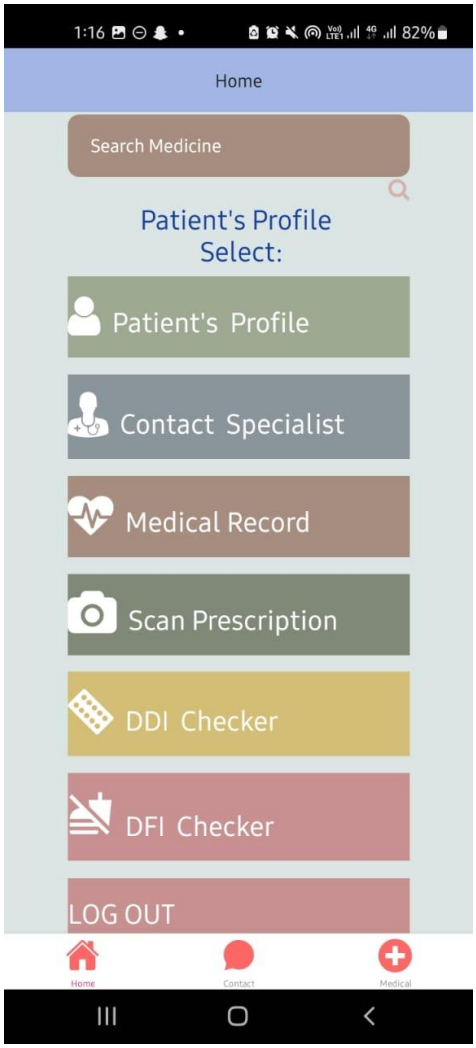


Fig:12 patient home screen

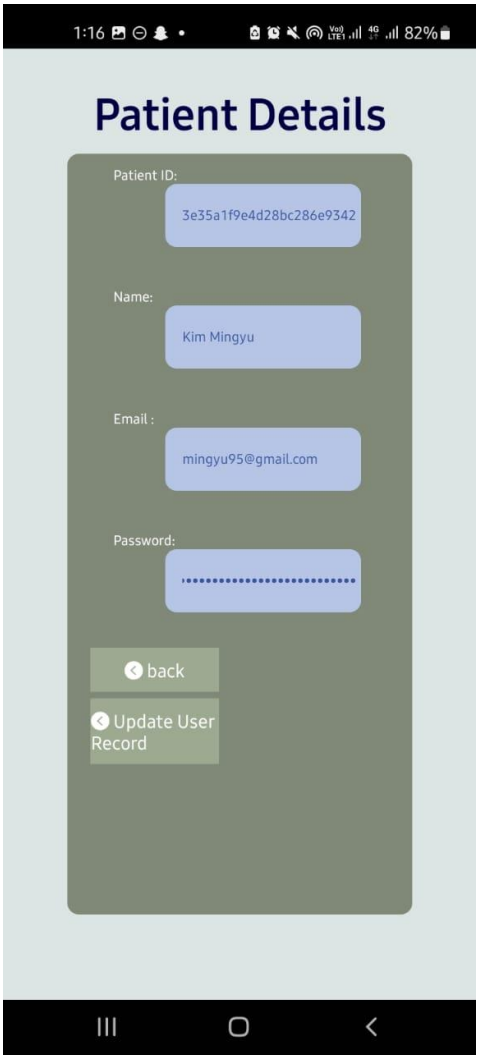


Fig: 13 Patient's details

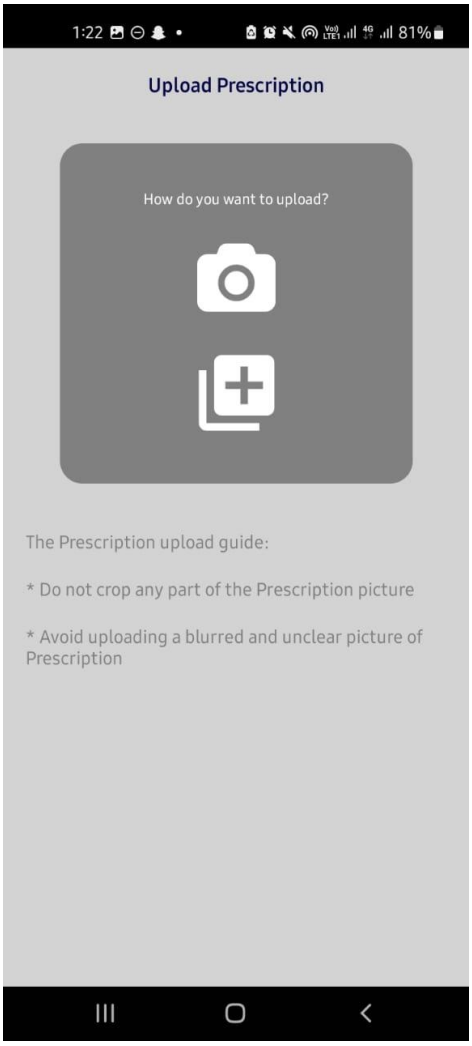


Fig: 14 Upload Prescription

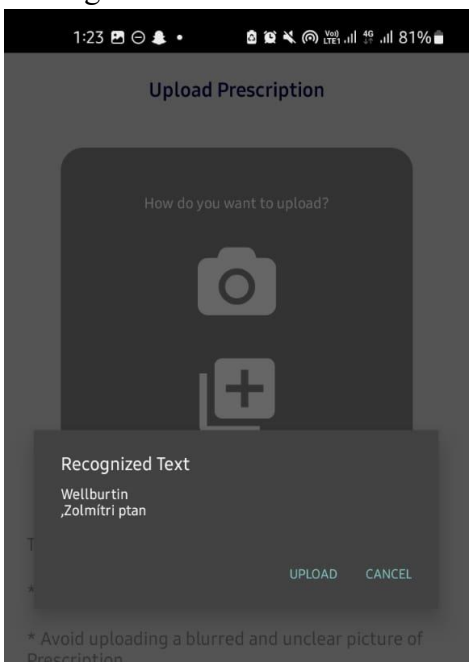


Fig: 15 Scanned Prescription data

Fig: 15 Medical Record

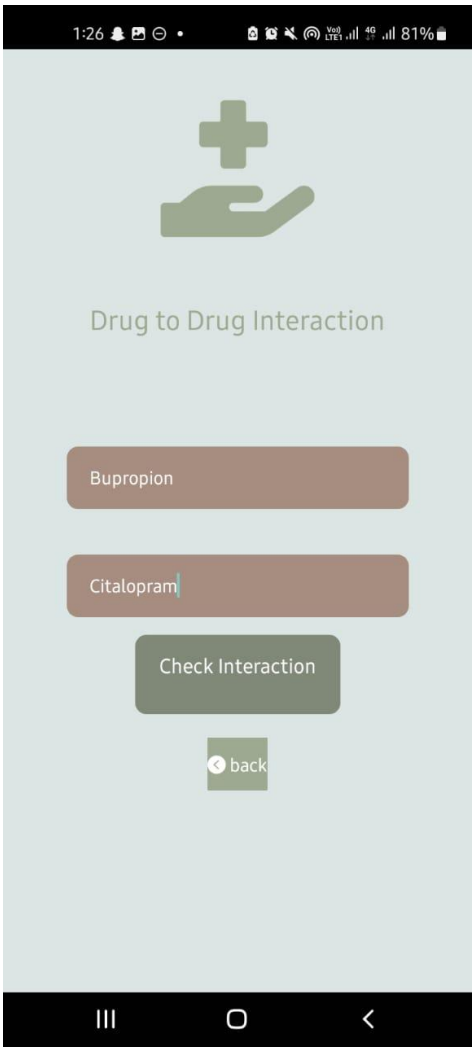


Fig: 16 Drug to Drug interaction

Fig: 17 Drug to food interaction

Fig: 18 DDI result

Fig: 19 DFI result

Fig: 20 Contact Medical Specialist

Fig: 21 Available Medical specialist

Fig: 22 Search Medicine Result

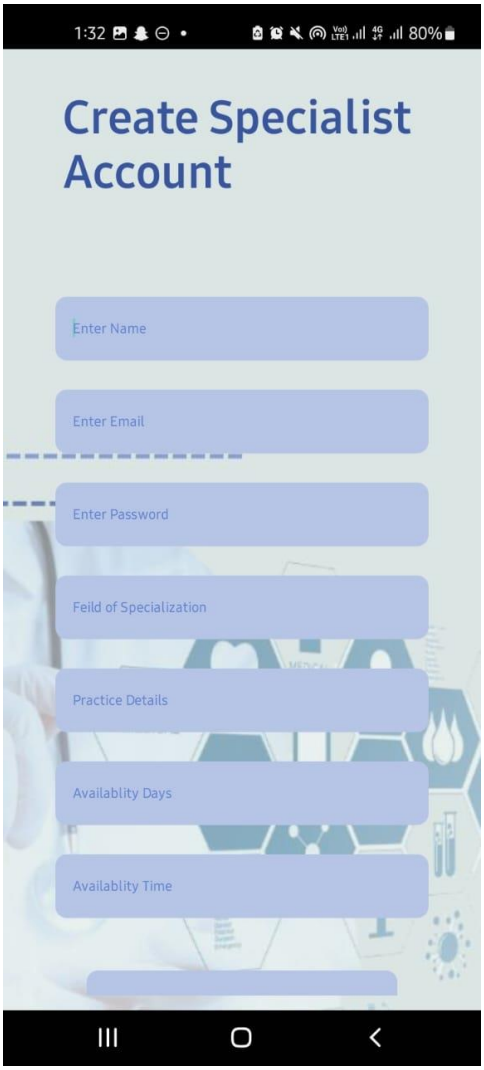


Fig: 23 Doctor SignUP

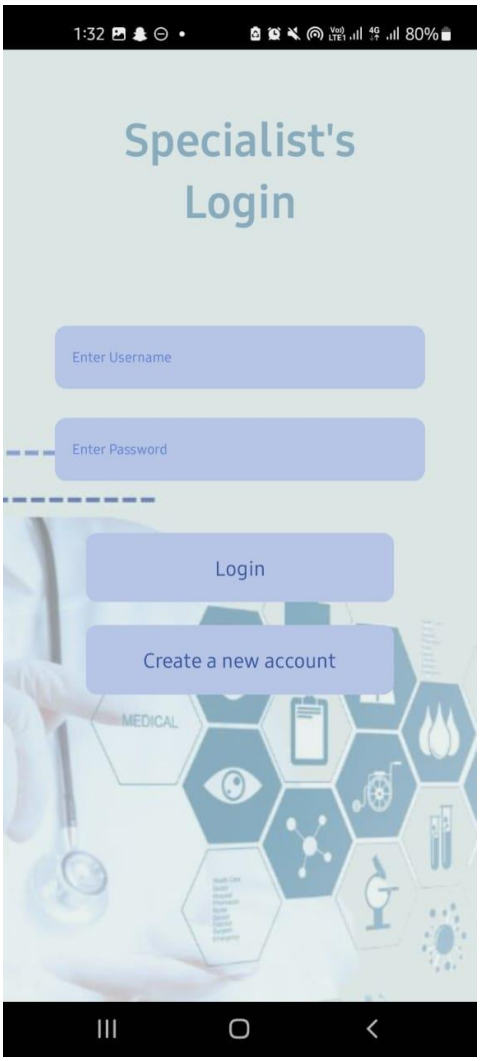


Fig: 24 Specialist Login

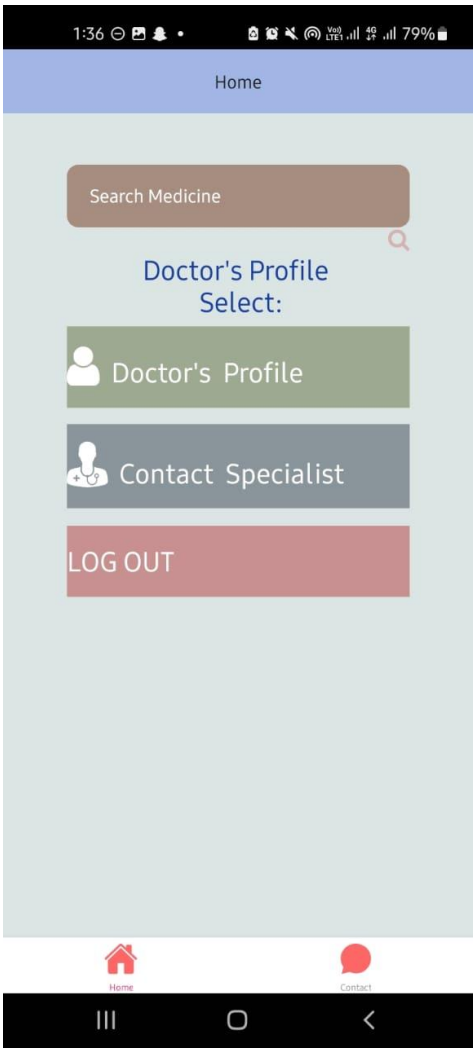


Fig: 25 Doctor's Home page

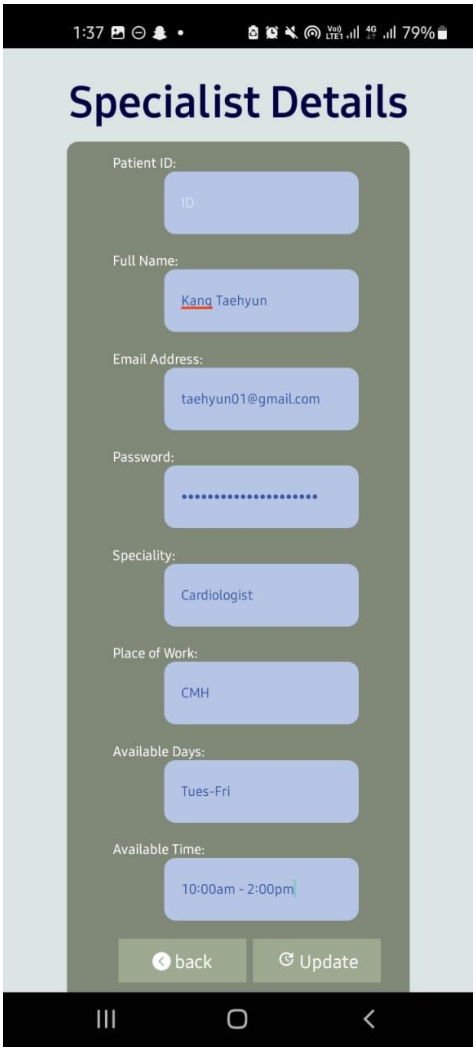


Fig:26 Specialist Details

4.3 Additional Information

There is no additional information to be included.

5. Other Design Details

There are no other design details.

6. Test Specification and Results

6.1 Test Case Specification

Table 6.1: TC-1

Identifier	TC-1
Related requirements(s)	Smart e.Pharmacist mobile application
Short description	Sign UP on the application as a Patient or Medical Specialist
Pre-condition(s)	Smart e.Pharmacist Mobile application
Input data	User Name, e-mail, password
Detailed steps	Enter your Full Name, e-mail and set a strong password
Expected result(s)	User is signed UP
Post-condition(s)	-
Actual result(s)	User is Signed UP
Test Case Result	✓

Table 6.2: TC-2

Identifier	TC-2
Related requirements(s)	Smart e.Pharmacist mobile application
Short description	Login to new or existing account
Pre-condition(s)	SignUP section should be completed first
Input data	e-mail, password
Detailed steps	Enter your e-mail and password that was used in the SignUP process
Expected result(s)	User is Logged into their account
Post-condition(s)	The entered password is correct
Actual result(s)	User is Logged in
Test Case Result	✓

Table 6.3: TC-3

Identifier	TC-3
Related requirements(s)	Smart e.Pharmacist mobile application
Short description	Creation of Patient Profile
Pre-condition(s)	User must be Logged in with a new account
Input data	Past Medical Record, Prescription
Detailed steps	Enter your medical record, any diseases or allergies that the user might have. Upload the doctor prescribed prescription into the system.
Expected result(s)	Patient Profile is created
Post-condition(s)	User must be logged in
Actual result(s)	Patient profile is created
Test Case Result	✓

Table 6.4: TC-4

Identifier	TC-4
Related requirements(s)	Smart e.Pharmacist mobile application
Short description	Creation of Medical Specialist Profile
Pre-condition(s)	User must be Logged in with a new account
Input data	Field of Specialization, Practice Details, Contact information
Detailed steps	Enter the Doctor's field of specialization. Place of work, availability days, Available time Contact information that includes user's email address.
Expected result(s)	Medical Specialist Profile is created
Post-condition(s)	User must be logged in
Actual result(s)	Medical Specialist profile is created
Test Case Result	✓

Table 6.5: TC-5

Identifier	TC-5
Related requirements(s)	Smart e.Pharmacist mobile application
Short description	Search Medicine
Pre-condition(s)	User must be Logged in
Input data	Medicine common name
Detailed steps	Enter a medicine's common name to search
Expected result(s)	Medicine's information
Post-condition(s)	User must be logged in
Actual result(s)	Medicine's information is displayed
Test Case Result	✓

Table 6.6: TC-6

Identifier	TC-6
Related requirements(s)	Smart e.Pharmacist mobile application
Short description	Drug to Drug Interaction Checker
Pre-condition(s)	User must be Logged in
Input data	Drug 1 and drug 2
Detailed steps	User enter names of 2 drugs to search for their compatibility
Expected result(s)	Interaction of two given drugs is displayed
Post-condition(s)	User must be logged in
Actual result(s)	Interaction of two given drugs is displayed
Test Case Result	✓

Table 6.7: TC-7

Identifier	TC-7
Related requirements(s)	Smart e.Pharmacist mobile application
Short description	Drug to Food Interaction Checker
Pre-condition(s)	User must be Logged in
Input data	Drug name and Food constituent
Detailed steps	User enter name of a drug and a food constituent to search for their compatibility
Expected result(s)	Interaction of two given drugs is displayed
Post-condition(s)	User must be logged in
Actual result(s)	Interaction of two given drugs is displayed
Test Case Result	✓

Table 6.8: TC-8

Identifier	TC-8
Related requirements(s)	Smart e.Pharmacist mobile application
Short description	Contact Specialist
Pre-condition(s)	User must be Logged in
Input data	-
Detailed steps	Click to contact a doctor
Expected result(s)	Doctors profiles are displayed
Post-condition(s)	User must be logged in
Actual result(s)	Doctors profiles are displayed
Test Case Result	✓

Table 6.9: TC-9

Identifier	TC-9

Related requirements(s)	Smart e.Pharmacist mobile application
Short description	Scan Prescription
Pre-condition(s)	User must be Logged in
Input data	Scan your prescription
Detailed steps	Scan or upload your prescription
Expected result(s)	Drugs are stored into database to check DDI and medicine names are stored in user's medical record
Post-condition(s)	User must upload a valid prescription
Actual result(s)	Interaction between the scanned drugs is displayed and medicine names are stored in user's medical record
Test Case Result	✓

6.2 Summary of Test Results

Table 6.10: Summary of Test Results

Module Name	Test cases run	Number of defects found	Number of defects corrected so far	Number of defects still need to be corrected
Module 1	TC1	0	0	0
Module 2	TC2	0	0	0
Module 3	TC3	0	0	0
Module 4	TC4	0	0	0
Module 5	TC5	0	0	0
Module 6	TC6	0	0	0
Module 7	TC7	0	0	0
Module 8	TC8	0	0	0
Module 9	TC9	2	1	1
Complete System	9	2	1	1

7. Project Completion Status

Table 7.1: Project Completion Status

Module Name	**Status** (Complete, Partially Implemented, Not Implemented)
Sign UP	Complete
Login	Complete

Patient Profile	Complete
Medical Specialist Profile	Complete
Search Medicine	Complete
Drug to Drug Interaction Checker	Complete
Drug to Food Interaction Checker	Complete
Contact Specialist	Complete
Scan Prescription	Partially Implemented
Complete System	95%

Table 7.2: Objective(s)/Target(s) Status

Target/Objective	**Status** (Completed, Partially Completed, Not Completed)	**Reason(s)**
Objective 1	Completed	
Objective 2	Completed	
Objective 3	Completed	
Objective 4	Completed	
Objective 5	Completed	
Objective 6	Completed	
Objective 7	Completed	
Objective 8	Completed	
Objective 9	Partially Completed	Needs further implementation and testing
Number of Targets Completed	8	
Number of Targets Partially Completed	1	
Number of Targets Not Completed	0	

8. Deployment/Installation Guide

Smart e.Pharmacist mobile application is currently available on local level. A user needs to have a built of the application in their mobiles. The application works on android phones.

9. User Manual

A user can do the following using Smart e.Pharmacist mobile application:

1. The user can create their account as a “Specialist” or “Patient” using their Full name, email id and password.
2. The user can Login into the application using their email and password
3. The user can view and update their account information
4. The user can view and update their medical record
5. The user can search medicines using “Search Medicine” feature
6. The user can scan their doctor prescribed prescriptions. The medicine’s name will be updated in user’s medical record
7. The user can check interaction between two drugs using “DDI” feature
8. The user can check interaction between a drug and a food constituent using “DFI” feature
9. User can contact medical specialist’s profile using “Contact Specialist” feature

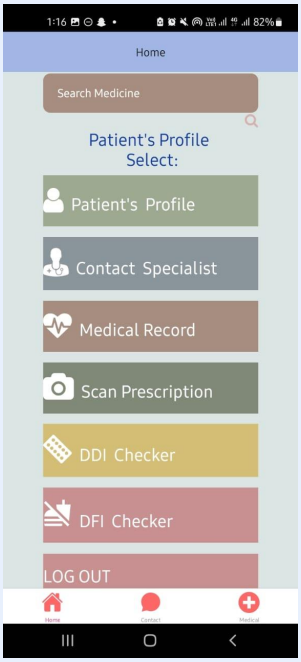
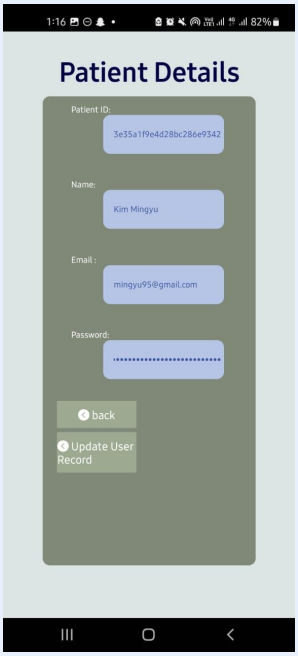
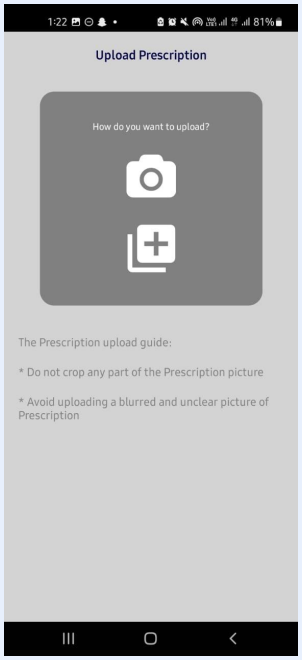
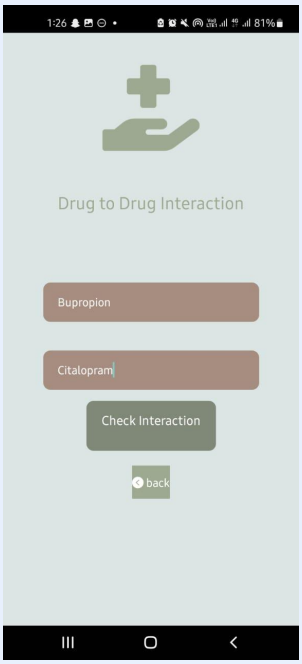
10. References

[1] Kit-Kay Mak, mallikarjuna Rao Pichika, Artificial intelligence in drug development: present status and future prospects, https://www.researchgate.net/publication/329144155_Artificial_intelligence_in_drug_development_present_status_and_future_prospects

[2] https://www.edureka.co/blog/best-laptop-for-machinelearning/#:~:text=RAM%3A%20A%20minimum%20of%2016,powerful%20and%20delivers%20Hi gh%20Performance.

11. Project Summary Form

Name of Project	Smart e.Pharmacist
Project Type	Choose an item.
Department	CS
Start Date	Click or tap to enter a date.
Completion Date	Click or tap to enter a date.
Supervisor / Team Leader	Sir Saeed Iqbal Khattak
Team Members (if any)	1. L1F18BSCS0246 Jaweria Tariq, 2. L1F18BSCS0234 Shahan Javed 3. L1S19BSCS0063 Muaz Kamran
Funding Agency (if any)	-
Amount of Funding (if any)	-
Assign SDGs to Project	Good Health and well being
Motivation of Project	To develop an application that will help the public to gain proper information about the medicines that they are consuming so they avoid taking multiple medications for same condition.
Practical / Potential Application	Click or tap here to enter text.
Abstract	Smart e.Pharmacist is a mobile application that can be used to search for medicines or alternatives to medication that a user is currently taking. Patients may take several medications for the same condition in the misguided notion that this may speed up the healing process, while in fact the Drug-Drug interactions of some prescriptions may cause harm to the patients. Using this app, the user can scan their doctor prescribed prescriptions, and the system will determine whether the medication combination is safe to take. The app is divided into two interfaces: one for patients and one for medical specialists. Users can look up medications, consult a doctor, check drug to drug interaction and so on. The artificial intelligence model is trained using dataset obtained from the DrugBank.
Key Technical Features	1. Search Medicines 2. Scan Prescription 3. Drug to Drug interaction checker 4. Drug to Food interaction checker

	5. Contact doctor
Projects Images / Screenshots	     


Drug to Food Interaction
Enter Drug 1
Enter Food Cons
Check Interaction
back


Contact Medical Specialist
Physicians
Cardiologists
Neurologist
Orthopedics
Gynecologists
Pediatricians
Pathologists
Radiologists
Dermatologists
Virologists
Pharmacists
Physoclogists

Appendix A: Glossary

Appendix B: IV & V Report

(Independent verification & validation)
IV & V Resource

Name Signature

S#	Defect Description	Origin Stage	Status	Fix Time	
				Hours	Minutes
1					
2					
3					
…					

Table B.1: List of non-trivial defects

This document has been adapted from the following:

1. Previous project templates at UCP
2. High-level Technical Design, Centers for Medicare & Medicaid Services. (www.cms.gov)