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جامعة النجاح الوطنية
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قسم نظم المعلومات المحوسبة

TAKE CARE

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Abstract

Each house nowadays contains a pile of medicines stored in either refrigerators or first aid cabinets. Some of these medicines might be still valid and others might be expired. Patients have to distinguish their medicines from each others, which could be a tough task for the elderly. Usually, medicines should be taken at specific times during day for a certain period, which might be difficult to remember. In addition, doctors normally ask patients to take their medicines either before or after meals.

In the project we present, we are willing to build a mobile app which takes place as medicine manager and track system for Arabian users. When a user opens the app to look up a new medicine along with its information, the camera is opened to capture a snapshot of the medicine cover and the OCR technology is used to search for corresponding medicine from a database. The app also remind the patients to take medicine on time. In case of medication delays, the system reschedules the medicine-taking process to adapt the new state.

Chapter 1

Introduction

Take Care is a beautiful visual application that is easy to use to remind you of medication dates. It will help you take your medication on time and in a safe way. It also allows you to help your family remind them about the dates of their pills.

Whether you are taking one or more drugs, you know of course it is a little difficult to take each medication at the right time. If you take care of one of your parents or children, of course you know the anxiety of not sure, whatever they have taken their medicines on time or not.

Take Care has built in an OCR Scanner that used for recognize medicine and drugs, to know more about drugs that you take and know the best use and warnings for your drugs.

All of these futures are exists in our application. It is free and simple!

Project Scope

The project will be used by patients, Elderly, Alzheimer's patients, illiterates, doctors, nurse and residents alone.

The purpose of this system is to:

- Allows you to register medications that must take periodically.
- Combines the time schedules of your family's medicines in one place.
- Reminds you of the appointment, even if your device is in sleep mode.
- Let you see a list of "imposed today" drugs and drop them off the list after you take them.
- Allows you to scan drug box or drug tray by camera, so you can know more information on what you taken and know more about drug warnings.

Problem Specification

Many patients do not remember the time of taking their medicines or may be overlooked for this because of being asleep or being busy or at work. However, not complying with deadlines for the treatment of certain drugs in some diseases may cause serious health problems or even doesn't bring the expected result."

Another factor that you may take drugs that don't know what they are used for or even why you take them, just because doctor prescribe to you to use it, or maybe you bought drugs from a while and you forget the use of these drugs and maybe you throw away the box or bulletin (النشرة) so it's hard to remember what this drug is prescribed for.

Goals and Objectives

- This application contains a great drug manager that regulates your medications and dosage schedules, and reminds you of when to take the medicine. You can add medication times and dosage doses to automatically remind you of these appointments.
- You can create reminders to take the medicine up to 4 times a day and remind daily and up to 7 days period, so that the application will remind you of medication taking times every day for a period you choose.
- Remind your medication appointments even if your device is locked, meaning you will not forget any medicine even if your device is locked.
- The app has an easy and simple user interface and contains expressive images that makes the app fun to use.
- Know more about drug you use and see warnings for your drugs

Motivation

- Help old people to identify their drugs and to know more about what they are taken.
- When you back from hospital or clinic with bag of drugs without tray or pharmaceutical bulletin, just slice of drugs, it is hard to identify what the drug is used to and what is for. In addition, it is hard to remember when you must take the pill.
- When you search for drug online is not guaranteed to be correct and maybe there is no full information about that drug.
- For nurse in (Hospital, Elderly Home, etc.) it is much easier to remind when some patients needs to take the drug.
- Pharmacist usually identify drugs and they are not available all the time.

System Requirement

This system is a mobile application. Elderly who have a particularly large number of medications with complex instructions should look into downloading Take Care. According to Google Play, the app makes following medication schedules easy. After entering the pills and their detailed instructions, it will send users reminders that include how much of each medication to take and how to take it. A major advantage of this app is that it also sends notifications.

For Developer

1. Java IDE Installed with JDK 8 or higher.
2. Lucene Integrated with Java Multithread server.
3. Port 40000 open on server.
4. JSON.
5. Google Firebase Database
6. RESTful API

For User

7. Android Device with Android 4.1 or higher.
8. Android Device with camera built in (Flash Light is Recommended).
9. Connection to internet.
10. Mobile or iPad with camera and internet and storage granted permission.
11. Google Play service 12.0 or higher

Project Plan and Schedule

This Project start at the end of January 2018 and should be completed before 15 May 2018. In addition, most of the project processes are run concurrently to achieve maximum optimization and quality.

	Task	Start Date	End Date	Status
1	Analysis SWOT Analysis Project Planning Interface designing	22 Jan 2018	1 Feb 2018	Completed
2	Gathering information Customers Surveys	2 Feb 2018	14 Feb 2018	Completed
3	Lucene Server Build	14 Feb 2018	22 Feb 2018	Completed
4	JSON Template Build	14 Feb 2018	19 Feb 2018	Completed
5	Build up the data	19 Feb 2018	25 Feb 2018	Completed
6	Screen Design	27 Feb 2018	10 Mar 2018	Completed

7	Screen Coding	5 Mar 2018	20 Mar 2018	Completed
8	Writing Documentation	1 Mar 2018	16 Mar 2018	Completed
9	OCR Scanner Built	18 Mar 2018	3 Apr 2018	Completed
10	Building the database	20 Mar 2018	5 Apr 2018	Completed
11	Notification Build	5 Apr 2018	1 May 2018	Completed
12	App list design	25 Apr 2018	2 May 2018	Completed
13	Analysis Arabic Drug API	25 Apr 2018	15 May 2018	
14	Google Firebase Real-time Database	1 May 2018	15 May 2018	
15	Web Interface to deal with API	1 May 2018	15 May 2018	
16	Modules integration	2 May 2018	10 May 2018	

Outline of the Project

Take Care project consists of six Chapter: Chapter one is an introduction that talks about project scope, system requirements, goals and project plan. Chapter Two discuss literature and methodology, Chapter three talk about requirements and chapter four talk about system use case and chapter five have a test cases and finally chapter six conclusion.

Chapter 2

Literature and Methodology

This chapter will introduce a background for the current system, and discuss the proposed system. The advantages of the proposed system will be identified. Methodology used is 'agile methodology' for the proposed system will be shown.

Introduction

The study of the current system is helpful to know the problems and avoid it. In this chapter, we are going to study the current system and what are the things that make our system better than current system.

The current system

Regularity in taking the medication on schedule, as determined by the doctor, is one of the most important challenges that may face the patient and is one of the most important factors to obtain the expected therapeutic outcome

Traditional methods of medication reminders:

- Tell your family and friends about your medication schedule so they can remind you.
- Place a list on the wall with the names of drugs and dosages and the time to be taken.
- Set the alarm to remind you if there is an important medicine that needs to be taken at a specific time.
- Make your medicine routine to help you remember.

System problems:

Oblivion: The most important factor may be the loss of treatment for its effectiveness.

Proposed System

Smart devices with different operating systems provide the ability to set alarms and messages to remind the user at a time of their own choice. These alerts can be automatically repeated over the days without problems.

Users who rely on this tool to schedule medication times can now benefit from an application Take Care.

Through the application, the user records all the drugs and then sets the time of the session, so that the application alerts the user when the time comes.

Advantages of the Proposed System:

- Get reminders for all your medication, times and displays your notes such as "take with food".
- Send your friends and family notifications if you want help staying on track if you miss a dose.
- The application includes the possibility of taking a picture of the medicine box to be shown when the alarm (Notification) is given when to take this medicine or another.
- If the user wants to set the alarm to take the medicine at specified intervals, he or she should only set the start time and the length of time between the alarm and the next alarm.

Feasibility Study

- **1. Description of products and services:**

Take Care helps you manage and take your medication on time. Take Care allows your family, friends & caregivers to aid by being alerted as to whether you took your medication or not.

- **2. Product Marketplace:**

The product will be introduced to the marketing sector. The target users are Elderly, Alzheimer's patient, doctor and nurse staff.

The application will be on Google Play Store, so it is available to everyone who has android device, but it will target the category mentioned above more specific.

- **3. Competitive analysis:**

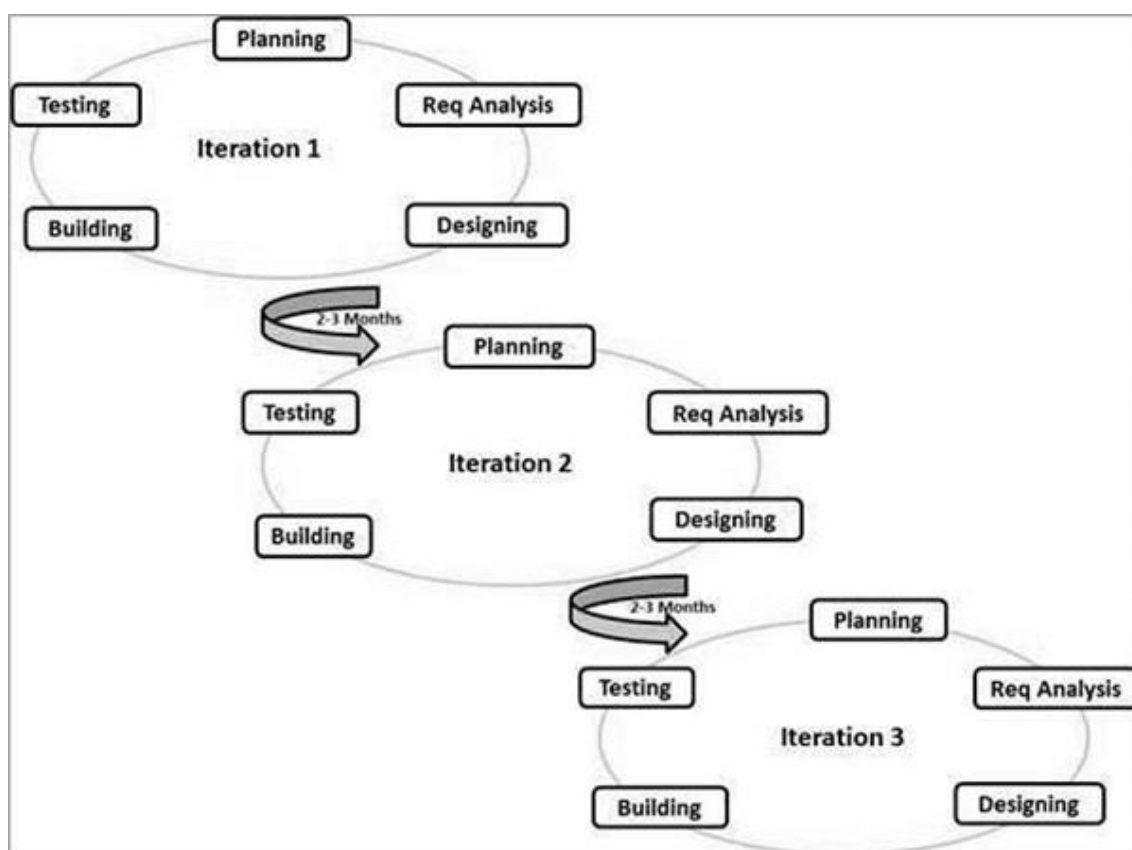
There are many competitors to our application and the advantage of us is the use of camera (OCR) to scan drug, all of these alternative are just alarms

- Medisafe.
- Adheretech.
- Meds Agenda.

Methodology (Agile)

Why agile?

Incremental delivery for the project, Deliver schedule task and make sure that are work properly, each delivery was planning and review to make a sure to deployment in perfect manner.



	Features	State	Release Number
1	Deploy Screen	Approved	1
2	Deploy Screen	Approved	2
2	Deploy Screen	Approved	3
4	Add flash button to OCR	Approved	1
5	Make UI Responsive	Approved	1
6	Make UI Support Arabic	Approved	1
7	Add Left swipe menu	Approved	1
8	Deliver Lucene Search Engine	Approver	1
9	Add history Tab	Approved	1
10	Add "Manual Add Drug"	Approved	1
11	Deliver OCR	Approved	1
12	Deliver List of drug	Approved	1
13	Deliver User Account	Not yet	-
14	Deliver Notification	Approved	1
15	Suggest Drug API	Approved	1
16	Google Firebase database	Not yet	-

Chapter 3

System Analysis and Design

In this chapter, we will discuss the analysis and the design phases in system development. During the analysis section, we will talk about requirement collection methods including interview outline, system service request, and prototype. This section also introduces studying and structuring requirements, also contains data flow diagrams of the proposed system.

Requirements Discovery:

To have all requirements and to understand the customer needs from: we had interviewed patients, elderly, Alzheimer's patients, and residents, as they are part of most requirement process.

Open Interview: we make an interview with more than one person and in this interview; we asked him what is the correct way to remember the date of the medicine and what to do if you forget to take it. How many drugs you take and forget what is do, or what is used for?

Requirements Classification and Organization:

Requirements prioritization and negotiation

After studying the requirements, it has been identified in all the System actor:

- First: Application User (Patient, Doctor, Nurse....)
- Second: API User

Functional requirements:

The first requirements to be specified are the functional requirements. They are listed below.

First: Application User

1. Medication:

- By accessing its medical record, a patient is able to:
 - add drug manually.
 - add via camera:
 - * Speed capture the writing.
 - * Quick response.
 - View Drug Item:
 - * view drug conflicts.
 - * view side effects.
 - modify the drug item.
 - delete a medication.
- A medication is composed of the following fields:
 - Medicine Name.
 - Dosage: how many units of medicine should take by intake.
 - Starting time of the medication.
 - End time of the medication.
 - Which day's frequency the medicine should be taken. Can choose between:
 - * Every day, up to 7 days interval
 - * Selecting Up to four deferent time in day
 - * A day's interval (i.e. "every ... day(s)")
 - How many times by day the medicine should be taken. The Patient can choose between:
 - * Up to four times per day,
- The medicine is chosen from a drug list.
- If the patient chose to specify an hour interval, he is also able to select the starting time of the intakes.
- If the patient chose to specify the number of intakes per day, the patient is also able to select at which hours those intakes should occur, even if the system pre-selects them.
- Adding a medication corresponds to fulfilling the field mentioned above. The mandatory fields have to be filled.
- The patient can cancel the process of adding or editing a medication.
- If the patient asks to delete a medication, the system should display a message to make the user confirms the action.
- The font is large.
- Supports Arabic language.

2. Notifications

If the user has enabled the push notifications:

- The system triggers a notification at the time of the intake to remind the user of his medication.
- Upon receiving the notification, the patient has the choice between 3 actions:
 - Click on Notification to open drug information
 - Swipe the Notification to down if there is an image to display the drug Image.
 - Swipe the Notification to right to allow more Notification to receive
- Send alerts without Wi-Fi.
- View the medication image with the notice.
- Alarm if the medicine is finished.
- The notification tone is the same as the mobile tone.

The Stories:

See current medications:

1. The User touches the button "Medication".
2. The application displays a summary of the recorded medications in the section "Medication".
3. The User touches one of the current medications to display the details of the medication.

Add a medication:

1. The User touches the button to add a medication or click the camera button.
2. The application displays the fields to fill:
 - Drug Name
 - Nutrition condition
 - Times
 - (Interval) Days:
 - * Every day
 - * Select days of the week
 - Frequency:
 - * Times per day.
 - Drug quantity.
 - Alert when drug is finish.

3. Search

The Search Accuracy must be 93% or higher.

- For 93% of search query, the result must be the first one of the retrieved document.
- First document return to the application.
- Drugs information must parse to display on application screen

4. Application it self

The Application must be responsive and achieve the best usability for old people.

- The Font size must be bigger when android font is big.
- The Application should make sound to alarm user even if the device is silent or in vibrate mode
- The Application should not do too much work for a small amount of job.

Second: API User

- Can Upload Drug information
- Get all drug from the database if needed
- Update And Drug on database

Nonfunctional Requirements:

- Usability: The Application design to be simple, clear, easy to understand and use by everyone with no previous background of how to use one and also must be easy remember how to use it.
- Reliability: gives the results on time (Drugs when search by OCR Scanner).
- Dependability: system passes the QA with minimal errors and crashes, the application will deliver the notifications in time to both sides (Application, Lucene Search Engine), with very low latency (< 1 sec) via Internet.
- Portability: compatible and can run on different devices (or all of them if possible).
- Availability: the Application will be available to the customers through mobile application. Maintainability: backup file contains to Google firebase for API and Local database (SQLite for Application).

Requirements validation.

Through the validation process, we used the following techniques:

- Group Session: we arranged meeting and interview with Supervisor to proposed the requirements that resulted in the previous process to gain feedback.
- Walkthroughs: checking the feasibility, opinion and approval on each requirement from sector specialists.
- Perspective-based reading: each single use case is reviewed independently by all team members.

Requirements management:

Take Care was developed using Agile method, so any changing in requirements has three possibilities, first, requirements change before release was developed, in this case no need for any plan because it's easy to change them, second requirements change while the development process, and after module has been released, in this case the whole module should be change according to what they asking for.

Chapter 4

System Design

- Static Context diagram

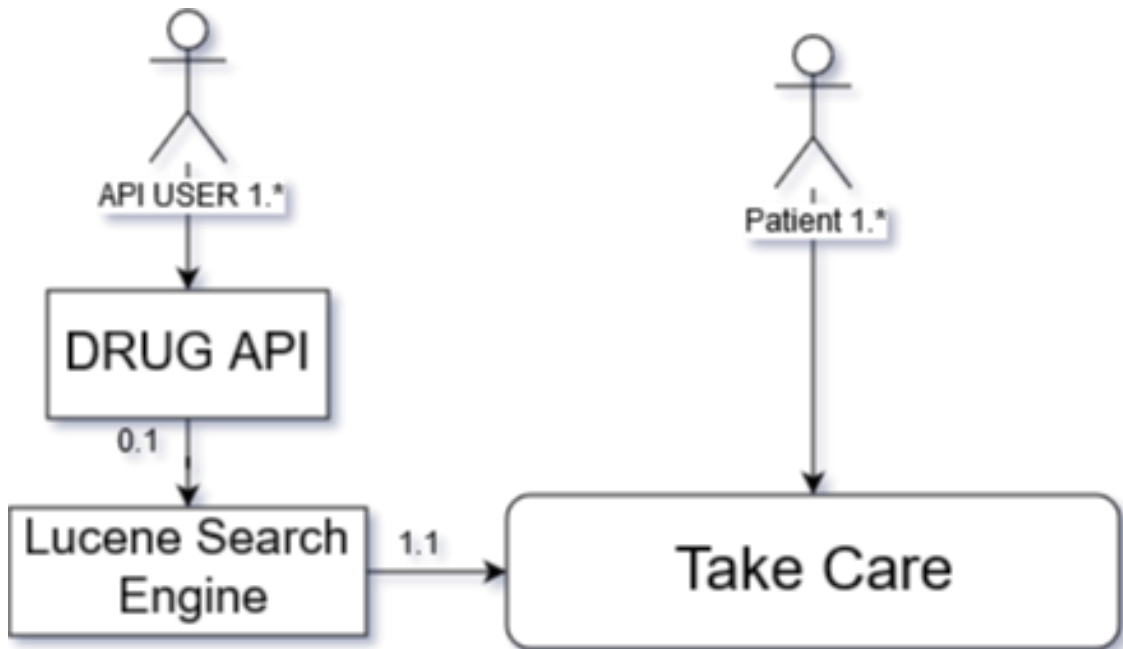


Figure 1: Context diagram

Use Case diagram

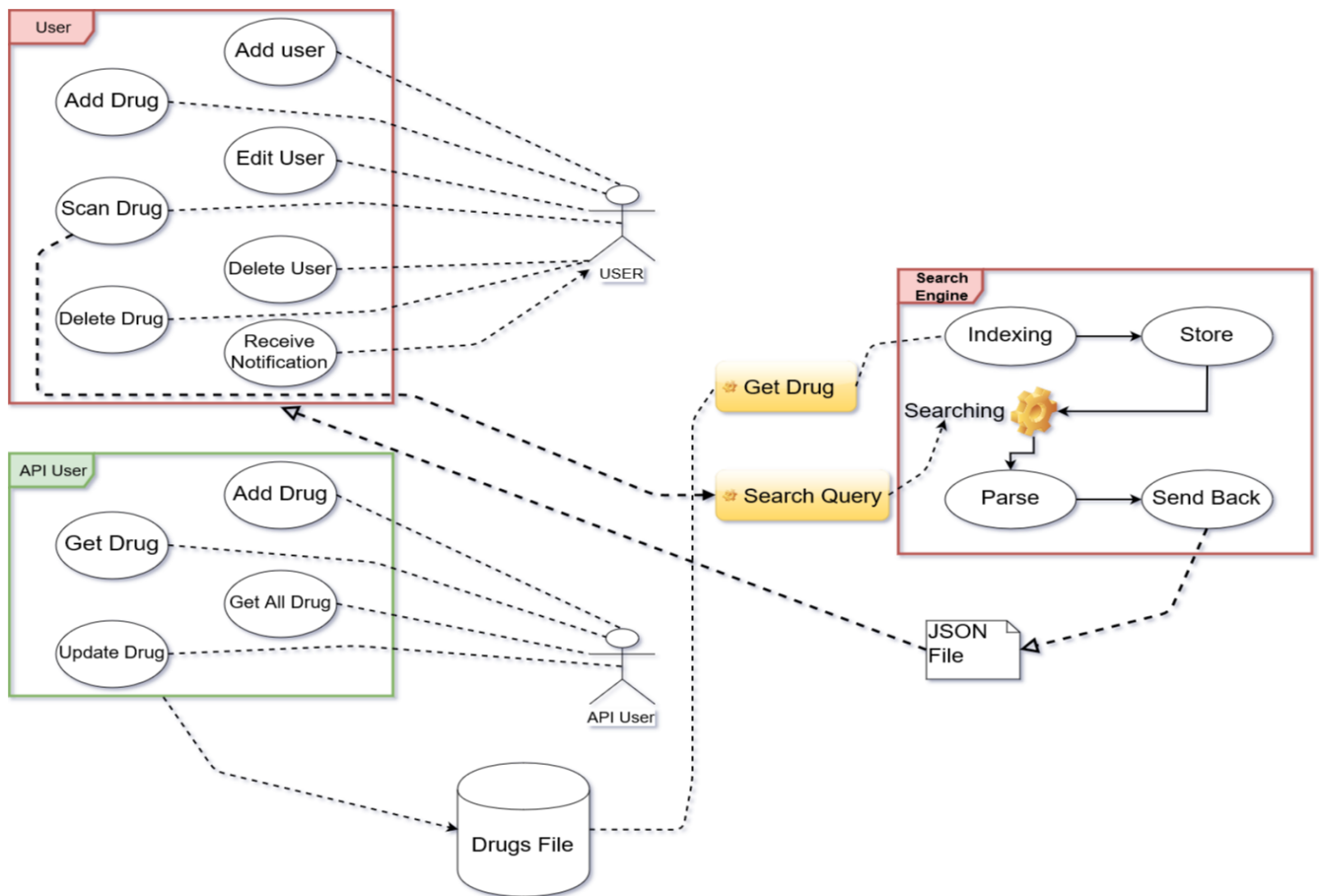


Figure2 : Use Case Diagram

Class diagram

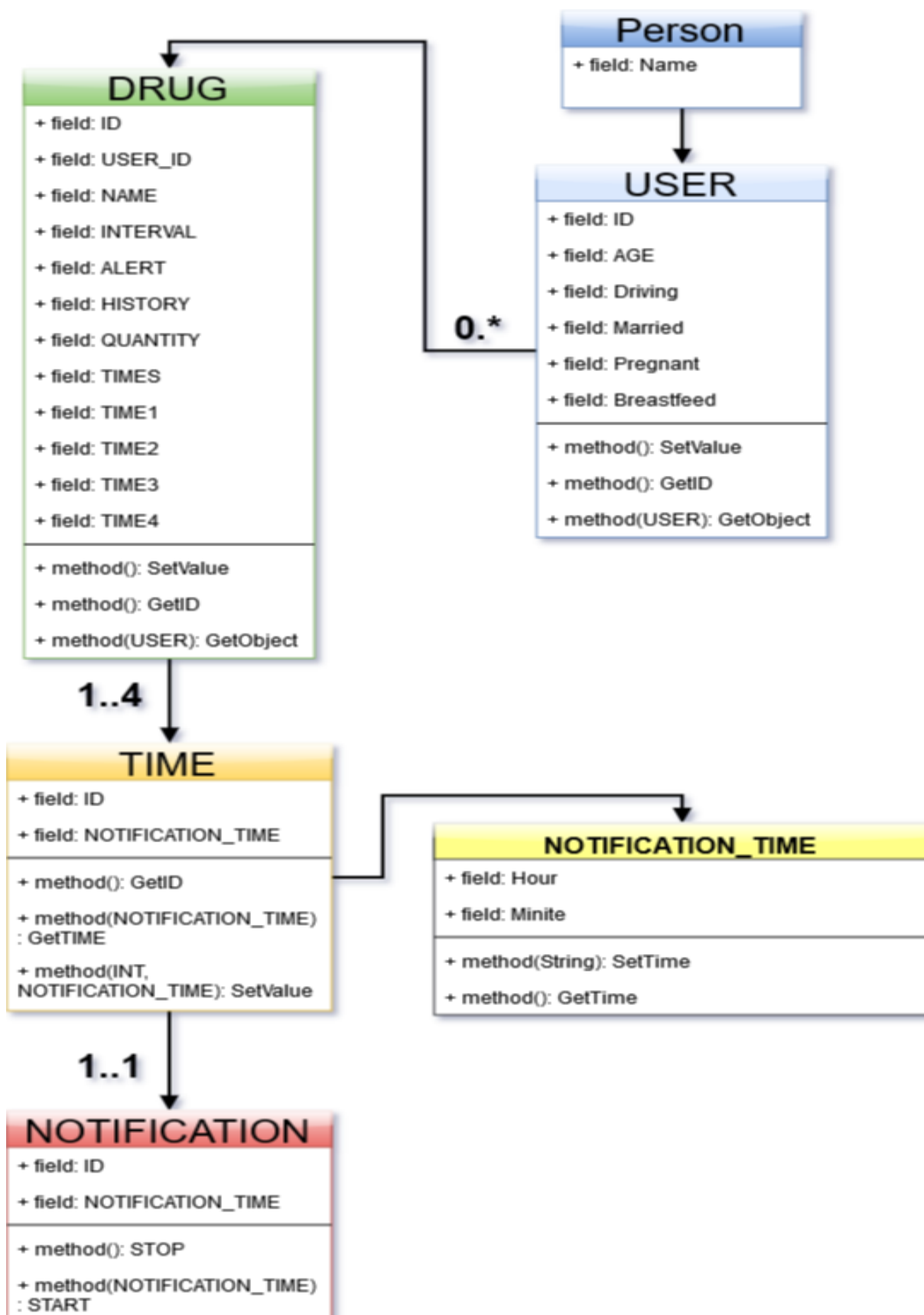


Figure 3: Class diagram

Activity diagrams

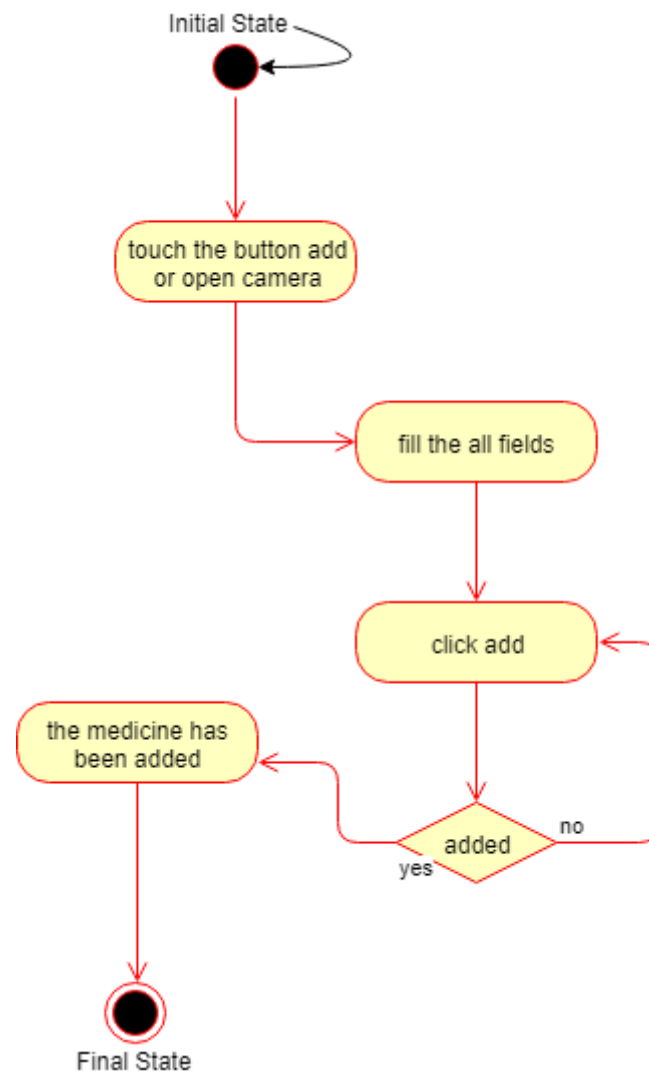


Figure 4: Add Drug

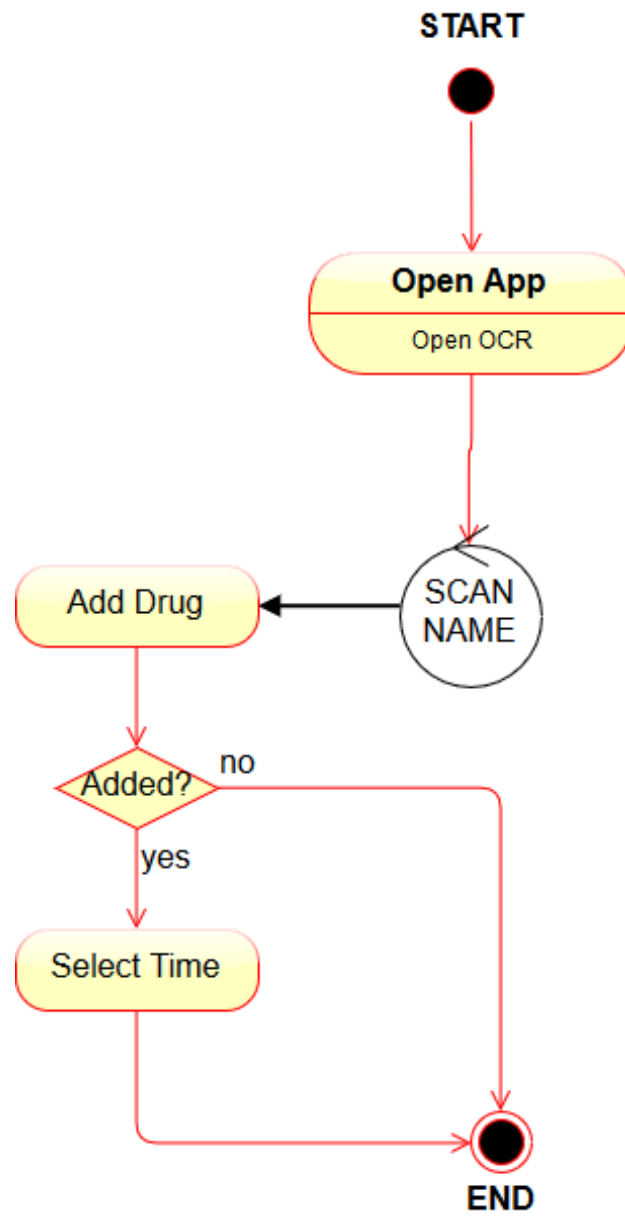


Figure 5: Scan Drug

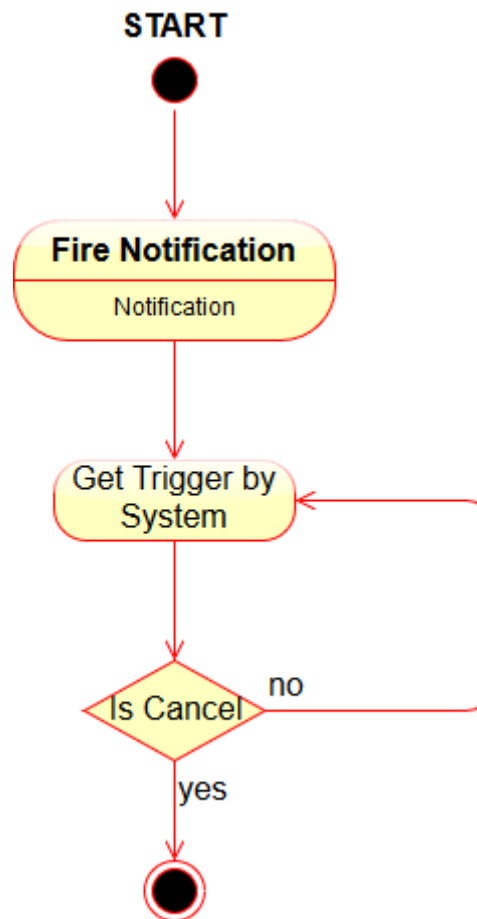


Figure 6: Notification Diagram

Sequence diagrams

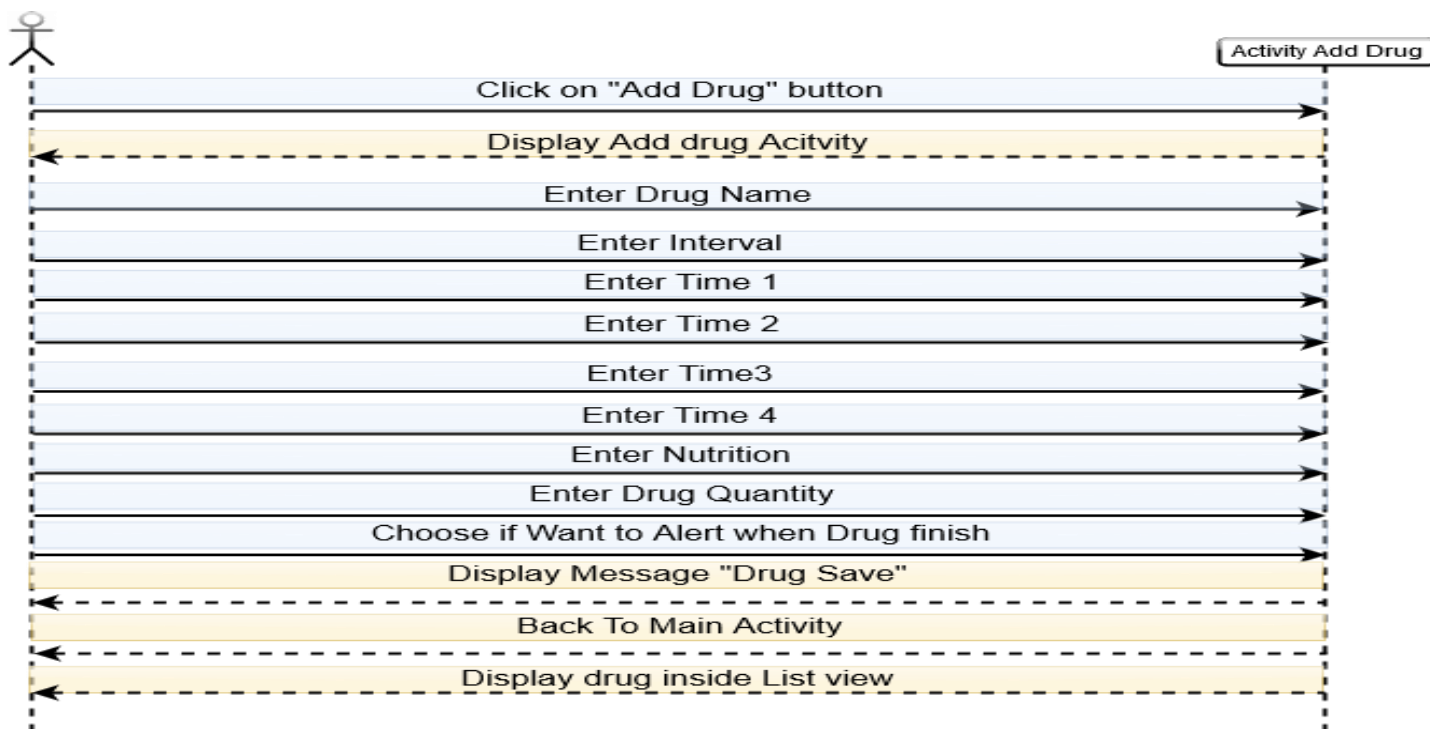


Figure 7: Add Drug Sequence

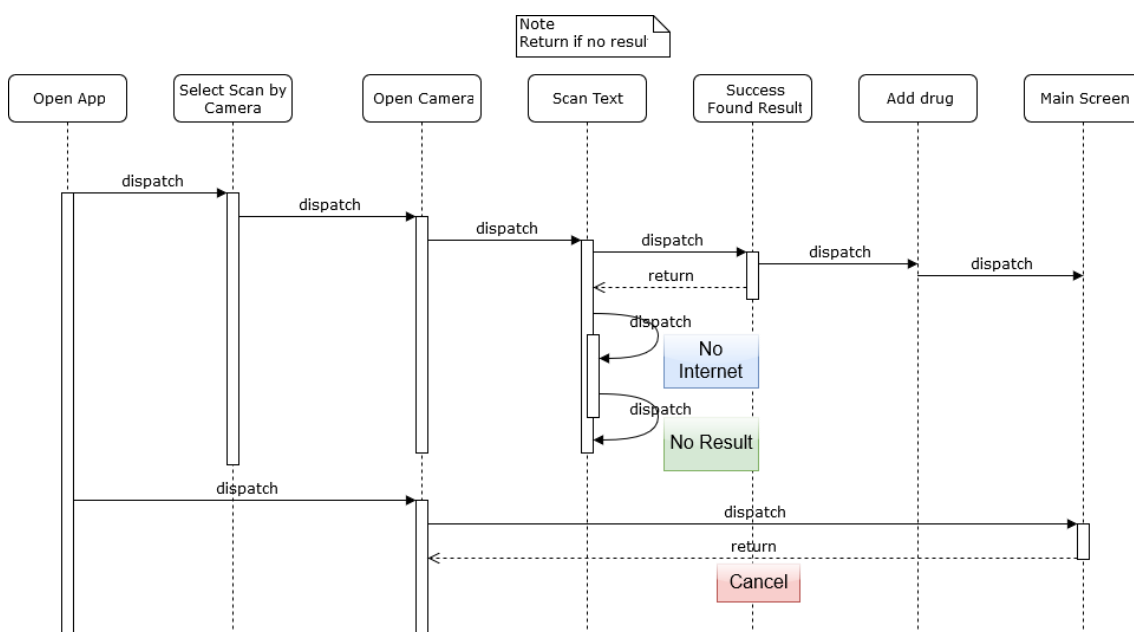


Figure 8: Search Sequence

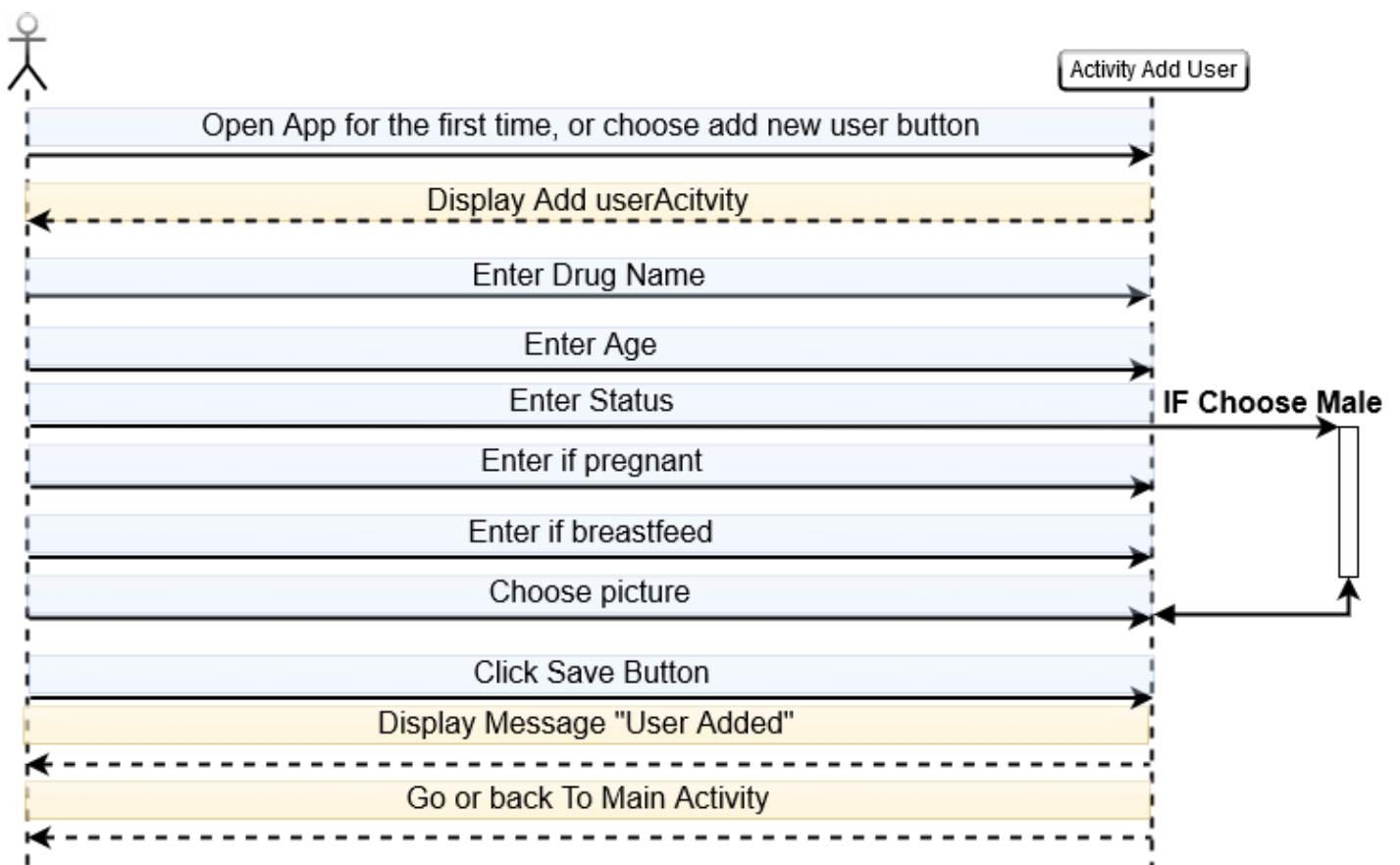


Figure 9: Add User Sequence

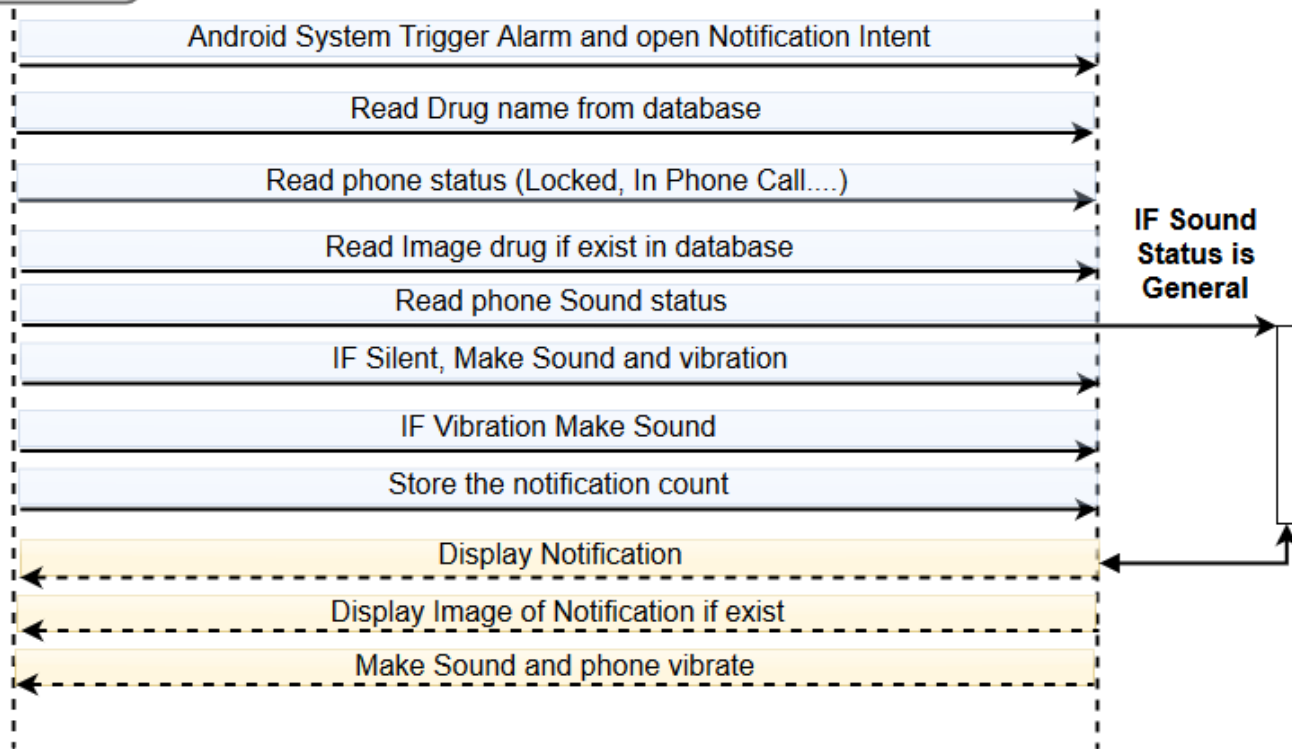


Figure 10: Notification Sequence

State diagram

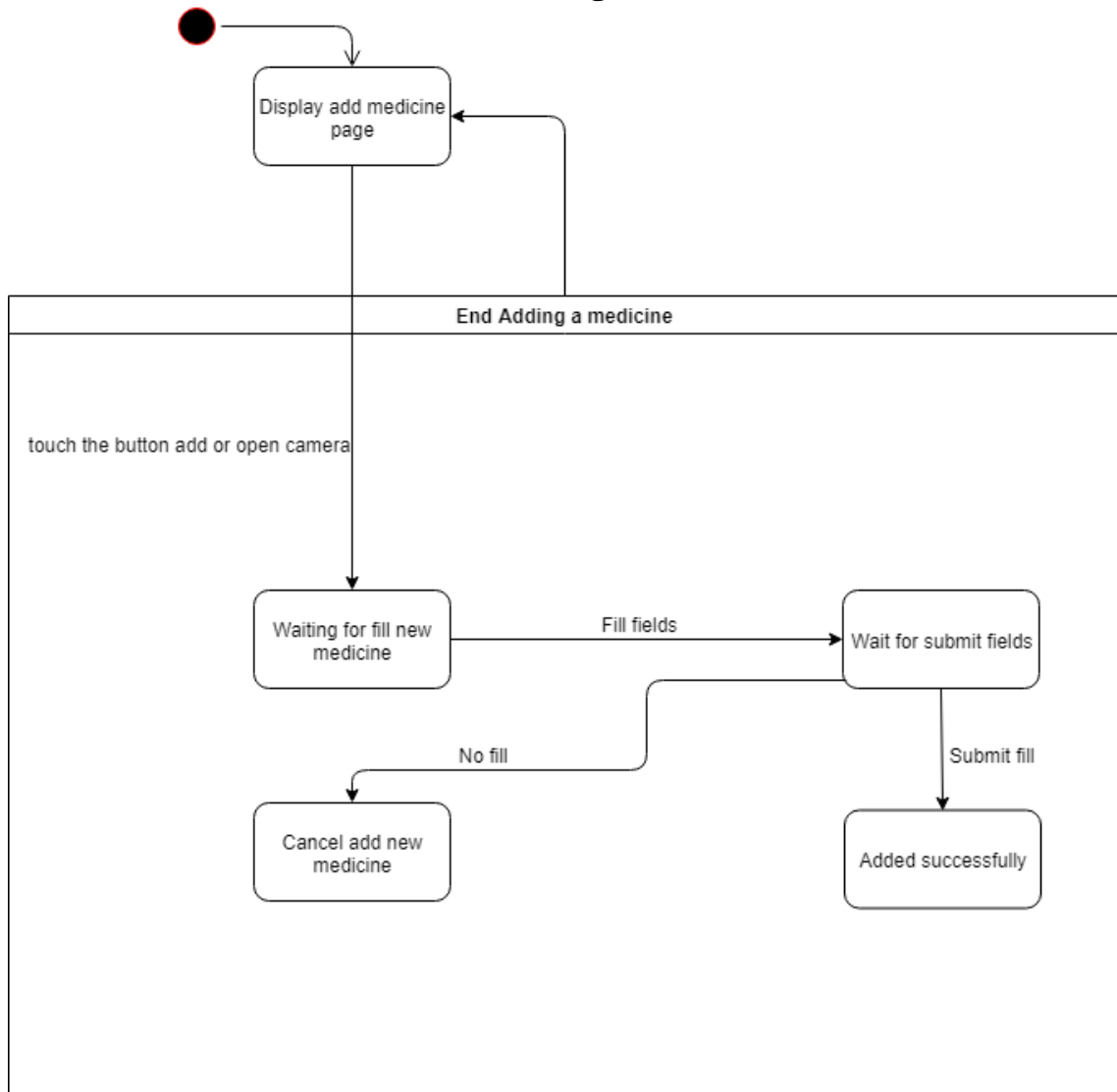


Figure 11: Add Drug State Diagram

Chapter 5

Test scenario

Project Name	Take Care				
Reference Document	Project Functional Requirement Specification , Version 1				
Created by	<u>Student</u>				
Date of creation	16-May-16				
Date of review	16-May-16				
Test scenario ID	Requirement-reference document index	Test scenario description	Importance	No. of test cases	
TS_1	Add User	Test the Add User functionality of the Take Care Application to make sure that registered user is allowed see his drug list	High	3	
		Validate if the user is able to see the Add User Activity when open the application for the first time	Medium		
		Validate if the user is able to edit the fields other than the following and save changes My Account <ul style="list-style-type: none"> ● First Name ● Age ● Choose Status ● Choose Sex ● Choose Driving Status ● Choose Pregnant Status 	High	10	
		Validate if the user can add user to the system			
		Validate if the user is able to open the application without registering	High	1	
TS_2	Viewing	Validate if the user can show his drug list	High	4	
		Validate if the user can show his history drug list	Medium	5	
		Validate if the user can view his profile	Medium	5	
		Validate if the user can view his drug information	Medium	2	

TS_3	Search	Validate if the user is able to search for drug by camera	High	1
		Validate if the system show the camera OCR	Medium	3
TS_4	Contact	Validate if the customer can connect with Seller	High	1
TS_5	Show Drug Information	Validate if the user is able to see drug information	Low	1
		Validate if the user can see warnings and drug details	Low	1
TS_6	Add Drug	Validate if the user can add drug by camera	Medium	25
		Validate if the user can add drug manually		
		Validate if the user can add image to drug		
		Validate if the user can choose interval		
		Validate if the user can choose time up to 4 times a day		
		Validate if the system fill drug info from the drug details (When Add drug by camera)		
TS_10	Change between user	Validate if the user swipe between users	Low	2
TS_11	Move Drug to history list	Validate if user can move drug to history	Medium	4
		Validate if the user can get back the drug from history		
TS_12	Delete Drug	Validate if the user can delete a drug from his history list	Medium	3
TS_14	Notification	Validate if the user can receive notification	High	6
		Validate if the user can receive notification on time		
		Validate if the user can receive notification with image if exist		
		Validate if the user can receive notification when phone is locked		
		Validate if the user can receive notification when phone is mute		
		Validate if the user can see drug name and condition in notification		
TS_15	Usability	Validate if the customer is able to open the application with an easy way	Low	4
TS_16	Performance	Validate if the user request a particular activity should be the response time does not exceed (2 seconds)	Medium	2
TS_17	Reliable	Validate if the application is dependable and does not contain error or bugs	Medium	2

TS_18	Maintainability	Validate if the application is easy to adjustment and easy to maintain with a little cost	Medium	3
TS_19	Speed and reliability	Validate if the user request a search activity should be the response time does not exceed (2 seconds) at the speed of the Internet (56 \ kb)	Medium	3
TS_20	Availability	Validate if the application is be available at any time (24 H)	Low	2

Test Case

Add user

Test Case ID	Test Objective	Precondition	Steps	Test Data	Expected result	Post-condition	Status
1	Successful User open Add User Activity	A valid name and data	Enter Username Enter Age Choose Photo Choose status	Valid data	Go to main Activity	Main Activity Displayed	Pass
2	Successful Add user without photo	A valid name and data	Enter Username Enter Age Choose status	Valid data	Go to main Activity	Main Activity Displayed	Pass
3	Test if can add user with empty field or one of field is empty	No data fill in text box		No Data	Display an Error that some of field is empty	Same Activity	Pass
4	Test if married female user can choose if she is pregnant or breastfeed	Choose Married female	Status: Married Sex: Female	Valid Data	Display a check box to choose if she is pregnant or breastfeed	Main Activity Displayed	Pass

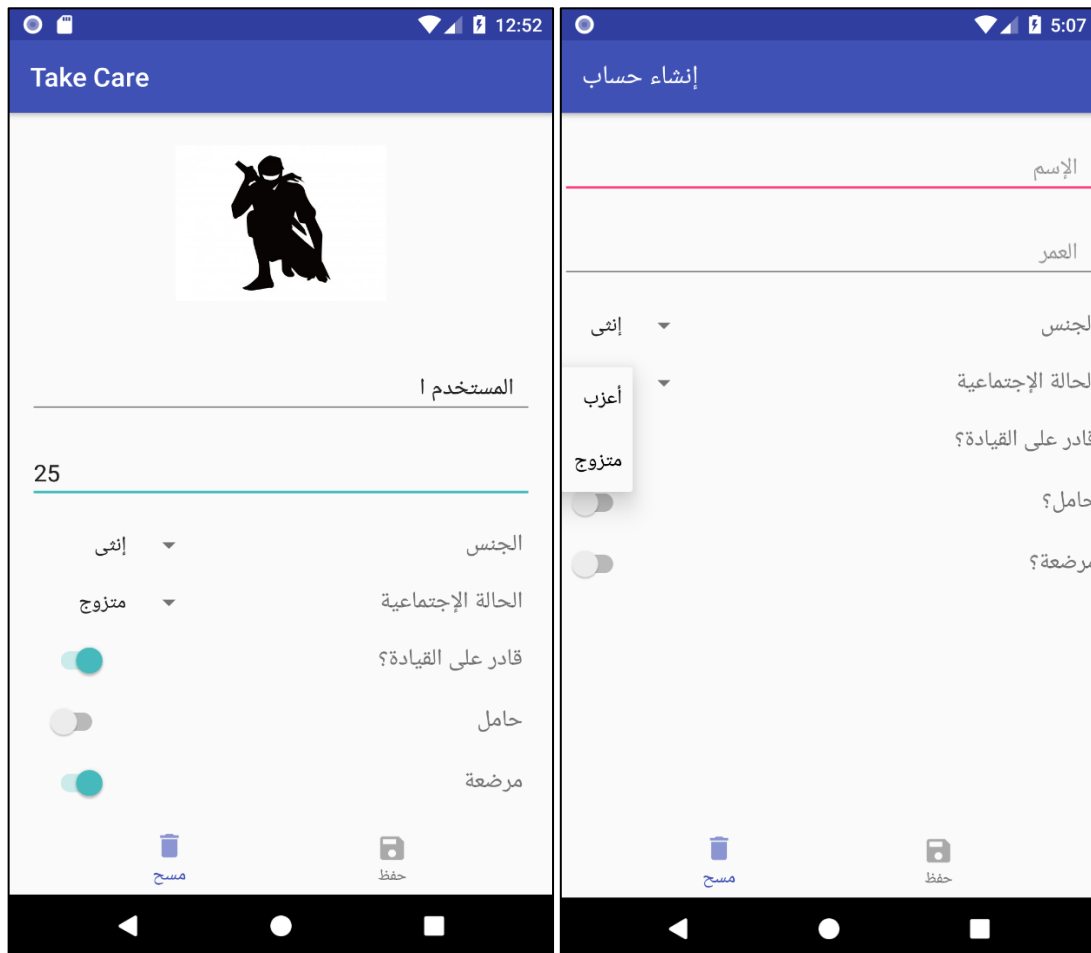


Figure 12: Add User Activity

Add Drug

Test Case ID	Test Objective	Precondition	Steps	Test Data	Expected result	Post-condition	Status
1	Successful User open Add Drug Activity	A valid drug name and interval and time	Enter Drug Name Choose Interval Choose Times Choose Photo Choose Nutrition Choose Quantity	Valid data	Go to main Activity and display in the list the new drug	Main Activity Displayed	Pass
2	Successful Add drug without photo	A valid name and data	Enter Drug Name Choose Interval Choose Times Choose Nutrition Choose Quantity	Valid data	Go to main Activity and display in the list the new drug	Main Activity Displayed	Pass
3	Test if can add drug with empty field or one of field is empty	No data fill in text box		No Data	Display an Error that some of field is empty	Same Activity	Pass
4	Test if This Activity open from OCR Activity	Choose add drug from OCR Activity	Choose Interval Choose Times Choose Nutrition Choose Quantity	Valid Data	Go to main Activity and display in the list the new drug	Main Activity Displayed	Pass
5	Test if user can pick up the time	Choose Time1	Choose Time1	Enter Time	Display the chosen time	Display the chosen time	Pass
6	Test if the user can add drug without choosing time	A valid drug name and interval just	Enter Drug Name Choose Interval Choose Photo Choose Nutrition Choose Quantity	Valid data	Display an error that you must pick up at least one time	Same Activity	Pass
7	Test drug is saved correctly after click save button	Activity Add Drug	Click Save Button	Valid data	Display correct information inside the list	Main Activity – List of drug displayed	Pass

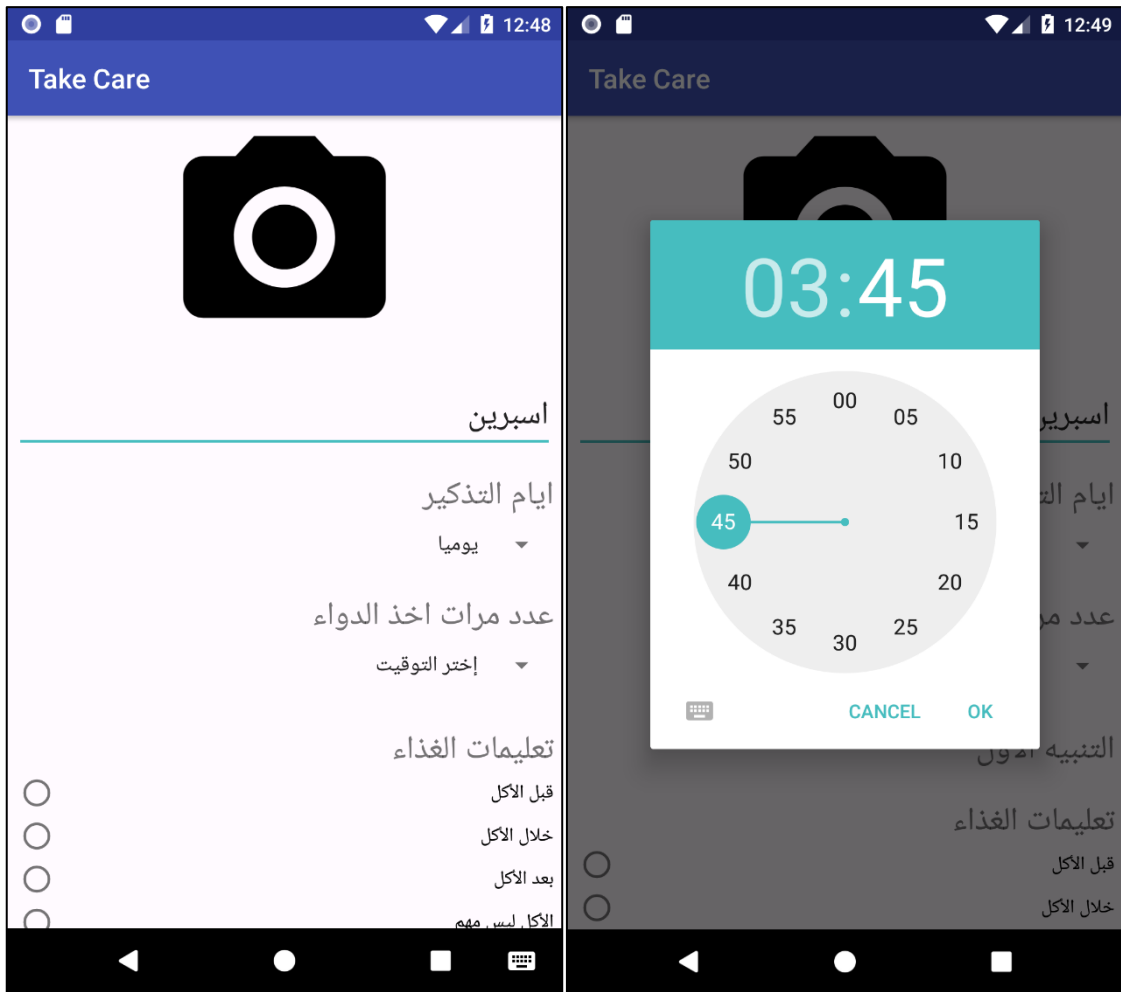


Figure 13: Activity Add Drug

Notification

Test Case ID	Test Objective	Precondition	Steps	Test Data	Expected result	Post-condition	Status
1	Successful Notification trigger	A valid drug with valid time inside the database	Open App and register if not Add drug manually or by OCR	Valid data	Notification Fired on chosen time	-	Pass
2	Successful Notification trigger without image inside the notification	A valid drug with valid time inside the database but without image	Open App and register if not Add drug manually	Valid data	Notification Fired on chosen time without Image	-	Pass
3	Test if Notification Display all drug information	A valid drug with valid time inside the database	Open App and register if not Add drug manually or by OCR	Valid data	Drug Name Displayed and nutrition also displayed	-	Pass
4	Test if Notification Make sound when device in vibrate mode	A valid drug with valid time inside the database	Make device in vibrate mode	-	Notification make sound	-	Pass
5	Test if Notification Make sound and vibration when device is silent	A valid drug with valid time inside the database	Make device silent	-	Notification make sound and also vibrate	-	Pass
6	Test if Notification fired on Specific time	A valid drug with valid time inside the database	Choose Time 12:00 to fire notification	-	Notification trigger on time (Maximum 60 Second Delay *From Android System)	-	Pass
7	Test if Notification repeat at the selected interval	A valid drug with valid time inside the database	Choose daily interval	-	Notification trigger everyday	-	Pass

OCR

Test Case ID	Test Objective	Precondition	Steps	Test Data	Expected result	Post-condition	Status
1	Test if OCR Activity Open	User register	Click on Scan with camera	Camera permission granted	Camera (OCR) Activity opened	Text Scan begin	Pass
2	Test if OCR Can read text from Camera	A valid and clear text	Click on Scan with camera	Drug Tray	Read Text that is on screen	Scan Proses begin	Pass
3	Test if OCR Activity display "No Result" When there is no result or text scanned	Dummy text or no text to read	Click on Scan with camera	No Data	Display an No result at the bottom of screen	-	Pass
4	Test if loading shape appear when search is complete	A valid and clear drug name	Click on Scan with camera	Valid Data	Loading appear at the screen	-	Pass
5	Test if OCR Can Take picture of drug when scan is complete	A valid and clear drug name	Click on Scan with camera	Valid Data	Display "Please steady" and picture taken for the drug	Go to drug information activity	Pass
6	Test if OCR Can't run when permission is not granted	Open app without giving the permission	Click on Scan with camera	Valid data	Display please give camera permission to App	Display "Please give camera permission to the app"	Pass
7	Test if The flash work when user click on Flash button	Dim The surround light	Click on Scan with camera	Valid data	Flash light ON	-	Pass
8	Test if flash light goes off when user turn off the flash light	Dim The surround light	Click on Scan with camera	Valid data	Flash light OFF	-	Pass

Chapter 6: CONCLUSIONS

Take Care App Design by the first place to help people, make life easier. In this project I Hope that this App to get some support and help, to maximize the promising benefit from it.

I will make this Project an Open Source Project, to get more worker to this project, also to help anyone want to make an OCR application, and with help with our API, we make the first Arabic Drug API to help people to get more and more of their progress to be done faster.

Future work

- First, make an iOS Version, and with help of Open Source community and most of Application service already built, this could achieve faster than we expect.

- Increase our data size, and increase our drug database, we could make this by our API, so we let the Drug company upload there drug information and database, and immediately indexing these records to make use of them.

- Apply Datamining technique when reach a big amount of users so we will improve our experience and improve the system at all.