Pillbox

Software Requirements and Design

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Revision History			
Date	Version	Description	Author
9/23/2017	0.1	Initial Draft	
9/30/2017	0.2	Added Activity Diagram	Joey Harter
10/1/2017	0.3	Added Class Diagram	Joey Harter
10/2/2017	0.4	Added Use Case Diagrams	Austin Schey
10/2/2017	0.5	Added project description	Austin Schey
10/2/2017	0.6	Added Requirements	Zac Linberg
10/3/2017	0.7	Modified functional and nonfunctional requirements	Austin Schey
10/25/2017	0.8	Added	Zac Linberg

		Sequence Diagrams	
10/27/2017	0.9	Added Add Pillbox Diagram	Zac Linberg
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10/30/2017	0.1.3	Added additional Sequence Diagrams	Joey Harter
10/30/2017	0.1.4	Added Database Diagrams	James Moore

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Introduction

Purpose

The purpose of this application is to act as a management tool for medications, especially for those who have complicated regimens and need assistance in remembering when to take their medications. The inspiration for the name *Pillbox* comes from a traditional pillbox which has compartments that are labeled for each day of the week. It is our goal to provide this same user-friendliness of a traditional pillbox along with the following added benefits:

- Notifications to remind the user when it is time to take each schedule dosage of medication.
- The user is able to log side-effects that they experience
- tracking a user's adherence to their medication regimen.

Scope

The application will allow the user to configure their medication schedule by adding a medication to their pillbox, including a photo of the pill, the name of the medication, the dosage size and the times that the pill should be taken. The system will notify the user to take their medication based off of their scheduled doses. The system will keep track of the user's adherence to their regimen and provide an intuitive interface that allows them to see when they have missed or skipped scheduled doses.

Definitions

Pillbox- the name of the application and also the main chart view showing the patient's medications

ADA- Americans with Disabilities Act, refers to guidelines in order to make the app useable by people with disabilities

Project Description

Medication Chart

This is the main feature of the application that will show all of the medications needed to be taken for the day or the week, depending on the user's selection. Pictures will be used to supplement the medication names displayed on the chart. The chart will have a popup screen that allows the user to add new medications and modify existing ones.

Daily View

This is the default medication chart that will be displayed to the user on the main activity. It contains the medication schedule for the selected day and the details for the selected medication. Each entry on the medication schedule displays the name of the medicine, the time it should be taken, an image of the pill and a colored indicator. There are four possible colors for this indicator.

- Green: Indicates that the dose was taken as scheduled.
- Red: Indicates that the dose was skipped.
- Yellow: Indicates that it is time to take the dose, but the user has not indicated that they have taken it.
- Grey: Indicates that the schedule time to take the medication hasn't occurred yet.

When the user taps a medication on the schedule, the medication's name, prescribed dosage, scheduled time, side effects, and an image of the pill will populate the upper half of the screen. There will also be buttons that the user will select to either skip the medication, indicate that they have taken the medication, or request another reminder for taking the medication.

Calendar View

This is the other type of medication chart that is available for the user to view. It is a monthly calendar, that for each past day since the application has been in use, the date has either or red or a green indicator on it. If the indicator is green, that means that the user took all of their required medication. If the indicator is red, it means that the user skipped at least one dose of medication that day. When the user selects a date, the application will navigate to the Daily View for the selected day.

Notifications

The system will be able to push notifications to the user's device to let them know when to take medications. The user will be able to acknowledge these notifications and specify the time that the medication was taken.

Requirements

Functional Requirements

1. A user shall be able create a virtual pillbox.
2. A user shall be able to take a picture of a label/pill and associate it with a medication.
3. A user shall be able to add and edit a schedule for each medication in their pillbox.
4. A user shall be able to indicate a medication as taken.
5. A user shall be able to view a chart that shows their adherence to their medication schedule.
6. A user shall be able to log side-effects associated with each medication.
7. A user shall be able to switch between a daily and calendar view of their medication schedule.
8. A user shall be able to view a daily view by selecting a day on the calendar view.

9. A user shall be able to see a detailed view of a pill when it is chosen from the daily view. The detailed view will show any side effects entered and the next scheduled time to take the medication.
10. A user shall be able to view/change the following settings:
    a. Default snooze period for a medication reminder
    b. Text size
    c. Speech-to-text on/off
    d. Text-to-speech on/off
    e. Version info
    f. Account settings
    g. Emergency contacts
11. From the detailed view, the user shall be able to elect to skip taking the next pill, change the reminder time, and/or take the pill now.
12. The system will show the user their adherence schedule using a color-coded system. A green dot next to a medication indicates the medication was taken on time, yellow indicates the medication was taken at an unscheduled time, and red indicates the medication was not taken.
13. The system must be able to notify the user when to take their medication based off a schedule defined by the user.
14. The system must be able to store the following information for each medication:
    a. Picture of the pill
    b. Consumption schedule
    c. Description of the medication
    d. Name of the medication
    e. Side-effects of the medication
    f. Emergency contact information
15. The system must be able to store a log of the user's adherence to their medication schedule.
16. The system must be able to display the user's medical information from the device's lock screen.

Nonfunctional Requirements

1. The user interface must be ADA compliant.
2. The user interface must be user-friendly to those with poor eyesight.
3. The system must be able to process a large number of pictures without a performance decrease.
4. The system must use its resources efficiently in order to reduce battery drain.

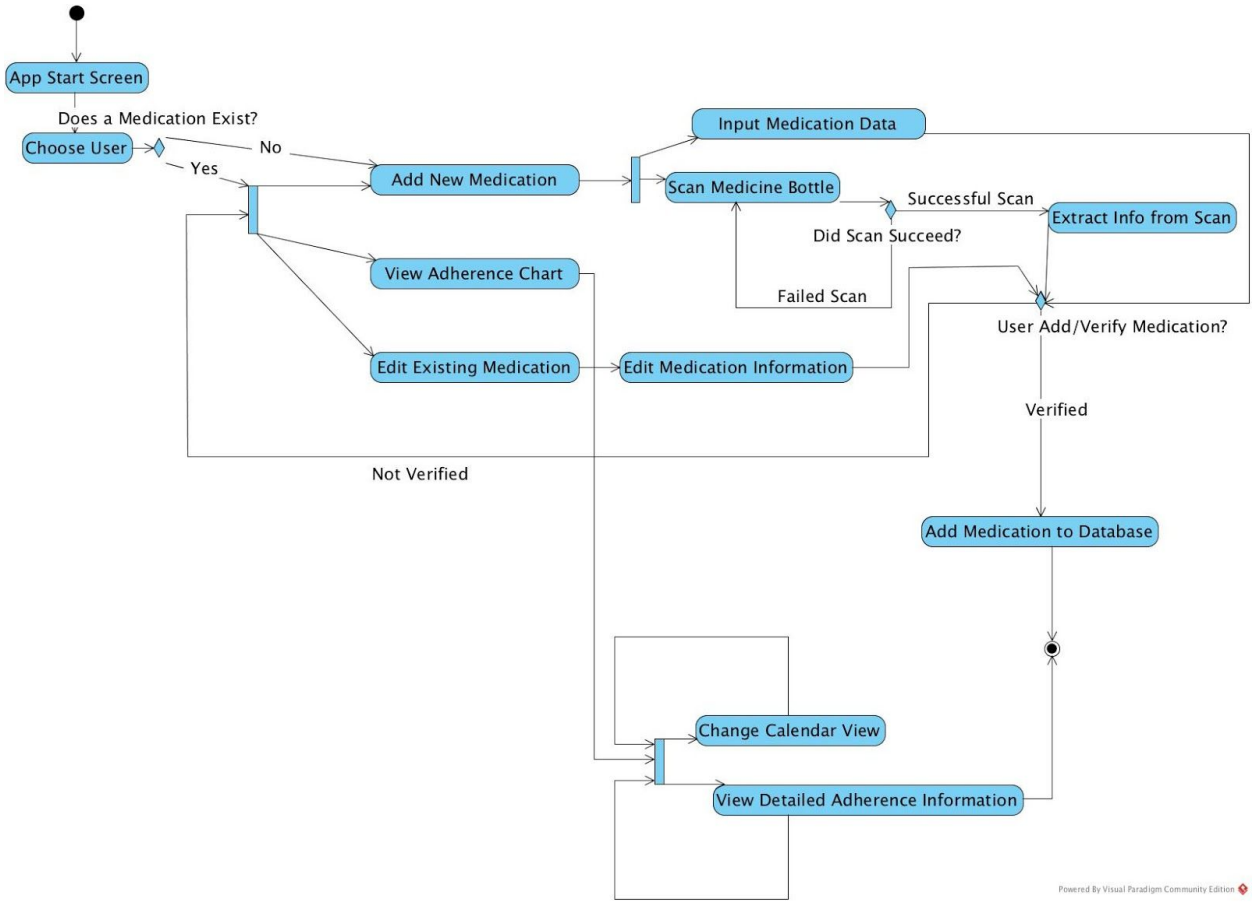
System Architecture

The system will be composed of these main activities.

1. The home page will show the user's medication schedule. This page can switch between a daily view and a calendar view.
2. The daily view will show a detailed view for the chosen pill at the top and a list of all other medications to be taken during that day on the bottom.
3. The add/edit medication page will be used to add or edit information for a selected medication.
4. The settings page will be used to edit account information and preferences.
5. The medication view will provide a summary for the selected medication.

UML Diagrams

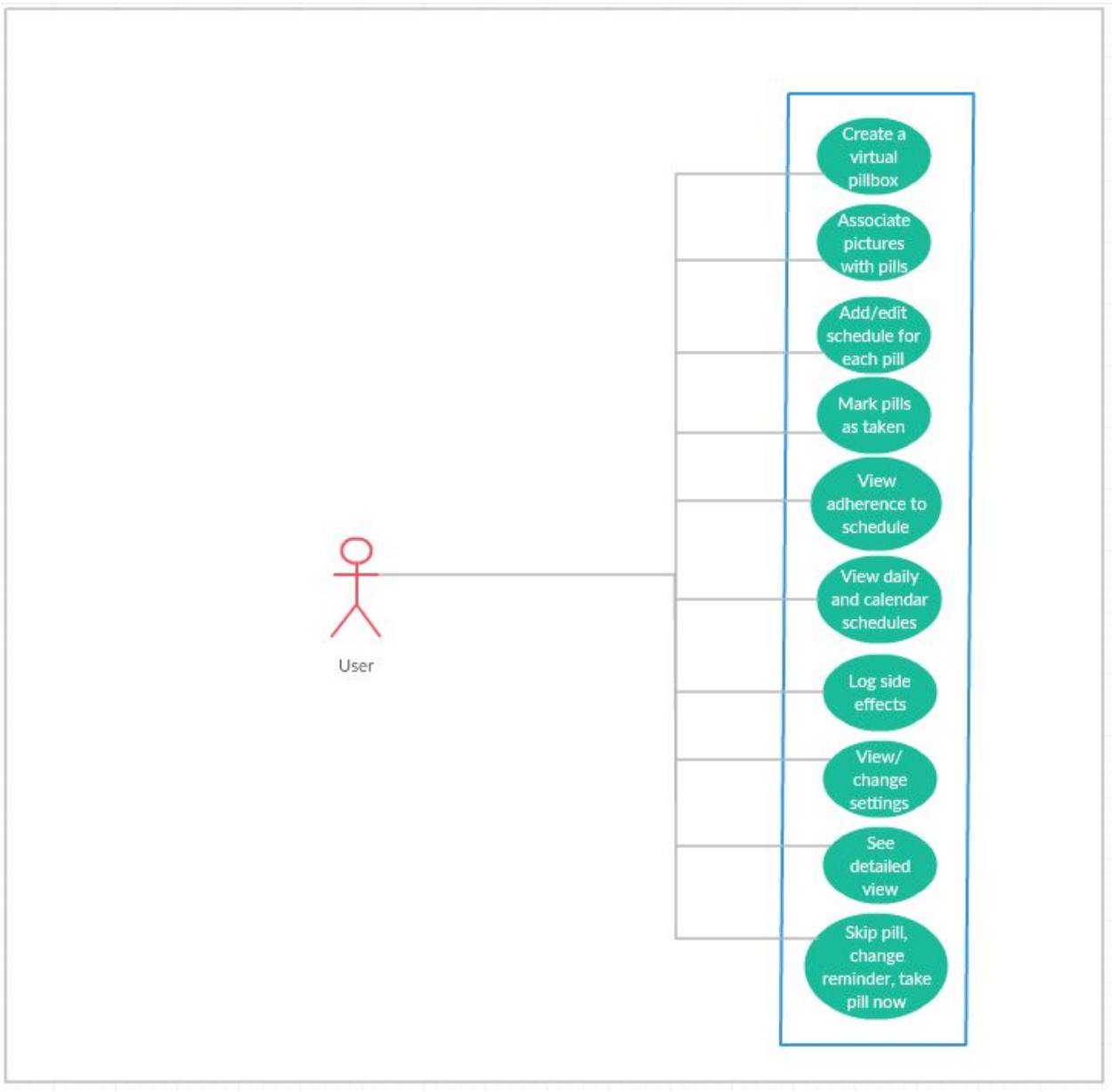
Activity Diagram



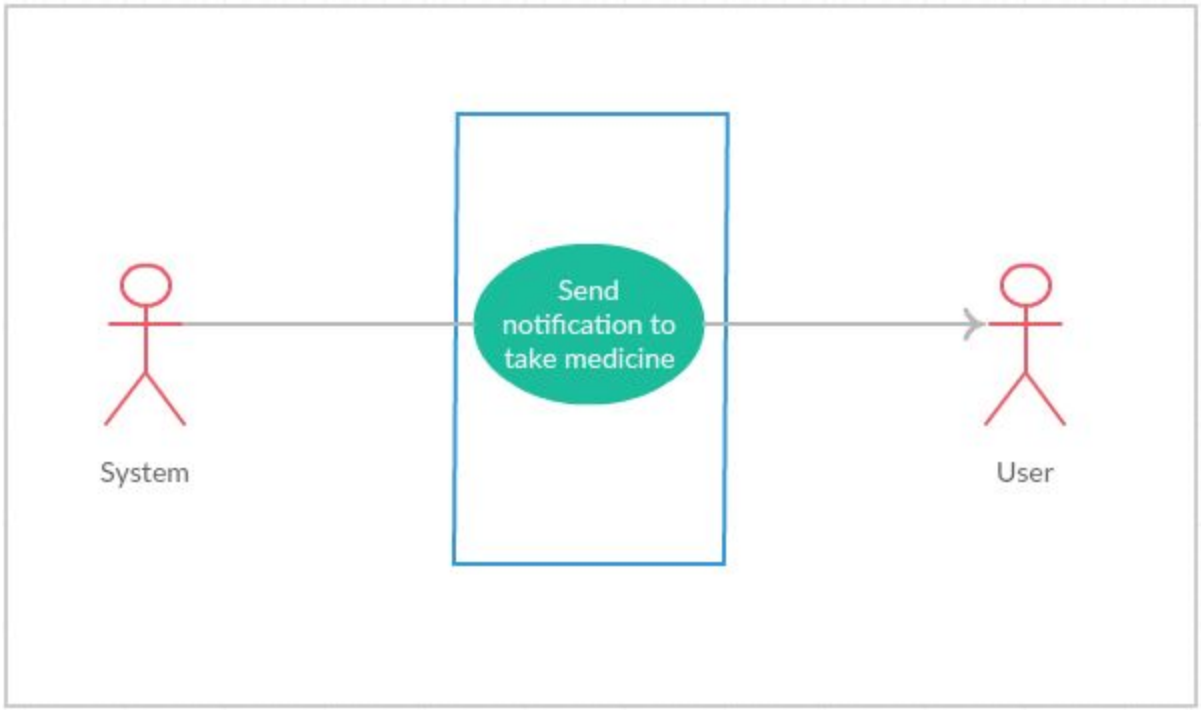
Activity Diagram Description

The activity diagram traverses through the three main views, adding/editing medications, viewing the adherence chart and scanning the medicine bottle. For adding/editing medications and using the scanning feature, the diagram eventually reaches a point where the user is required to verify the medication before adding it to the database. On the other hand, viewing the adherence chart allows the user to view detailed information or change the calendar view.

Use Case Diagrams

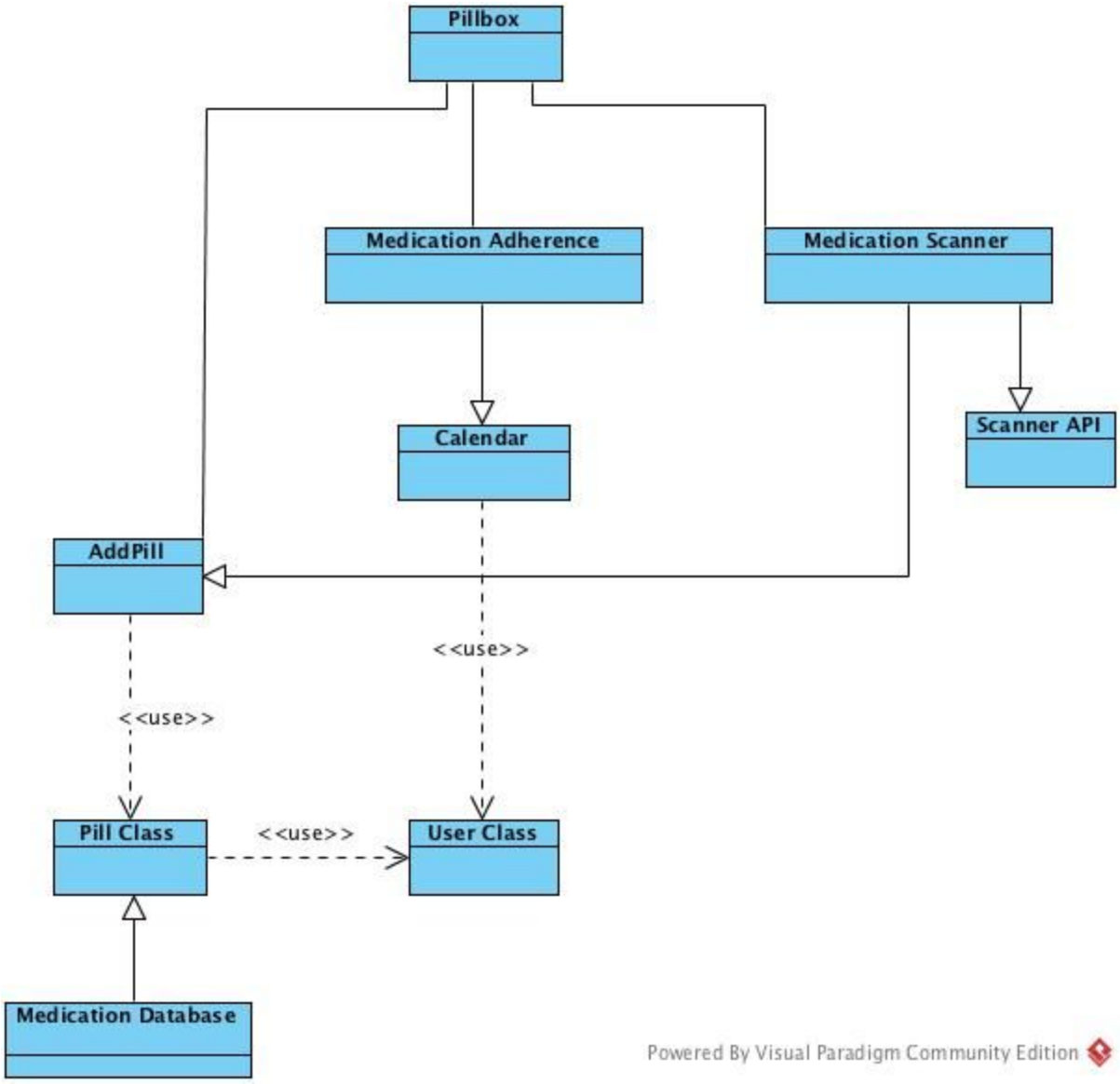


This diagram shows all the ways a user can interact with the application. Aside from adding/editing a new medication, the user interacts with the application through the main chart view.



The system is able to push notifications to the user to tell them to take their medication.

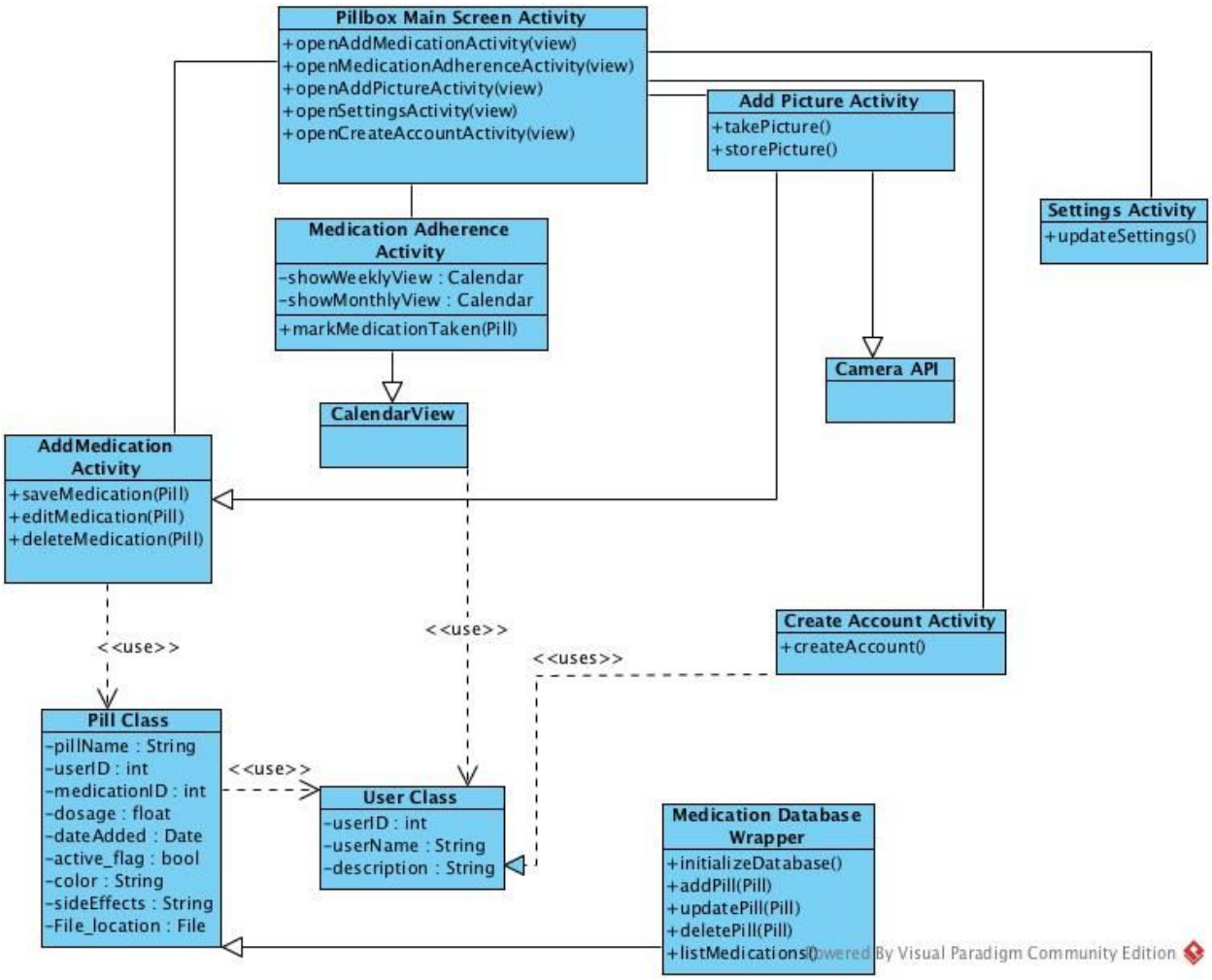
High-Level Class Diagram



The class diagram describes the three main activities: adding a medication, seeing the adherence chart and the scanning function. The Pill Class and User Class are the underlying classes in order to create and store the medication as well as for keeping track of what user

takes what medication. The Medication Adherence lass also utilizes a calendar class in order for users to easily see when they took their medication.

Detailed Class Diagram



Detailed Class Diagram Information

Pillbox Main Screen Activity: This is the initial screen that will be given to users if they have already previously created an account on the application. This screen will allow for users to be able to add a medication, view their adherence chart for their medications, add a picture of their medication bottle to start the process of adding a medication, creating or editing an account and updating the settings. The only time this will not be the initial screen is when an account has not been created, i.e. a user is using the application for the first time. In this case, the initial screen will go straight to the create account activity.

Add Picture Activity: This activity will be a more advanced, optional means of adding a medication to the pillbox. The user will be prompted to take a picture of the medication bottle, then it will save that picture and send the user to the add medication activity. The photo taken will be associated with the medication that the user adds immediately after taking the picture.

Camera API: This API will be used in conjunction with the add picture activity in order to take a picture of the medication bottle.

Medication Adherence Activity: This activity will use a calendar view, either monthly or weekly, to reveal to the user what medications have been taken or not taken over the given time period. Each date will be colored as either red, yellow, green or grey depending on if no medications were correctly taken, some medications were correctly taken or all medications were correctly taken. It will also allow for users to view detailed medication information.

Calendar View: This will be the primary view used by the medication adherence activity.

Settings Activity: This activity will simply be used to edit and save the settings for the application. This section of the project will also include standard information about the app and version information. The current settings we plan on implementing include:

- The ability to edit the default snooze period for medication notifications.
- Accessibility settings, which includes text size, speech to text and text to speech.

- Account settings, including the ability to list medical conditions, allergies, blood type and emergency contact information

Add Medication Activity: This activity will be used to create, edit or delete medications from a user's pillbox. A user will be able to add a picture of the medication, add side effects that have occurred or change their current schedule or dosage for each individual medication.

Create Account Activity: If a user desires, they can create an account in order to keep their adherence data separate from another user if they use a shared phone or tablet.

Pill Class: The pill class contains all information regarding a medication. This includes what the pill looks like, when to take each individual medication, side effect information, dosage information and what user is associated with the medication.

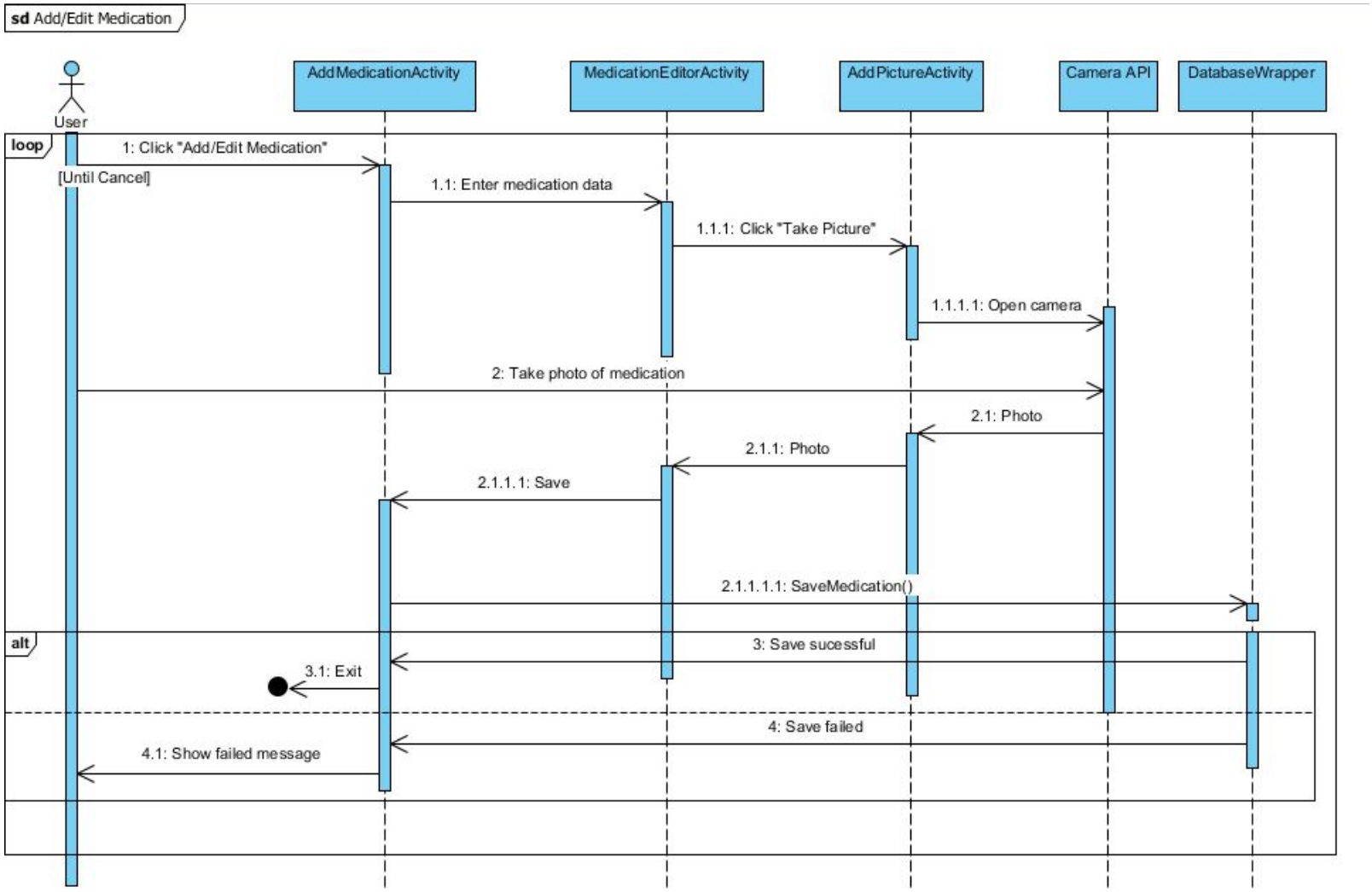
User Class: The user class simply manages multiple users within the application.

Medication Database: The database stores all medications and users. It also stores the adherence data for each medication.

Sequence Diagrams

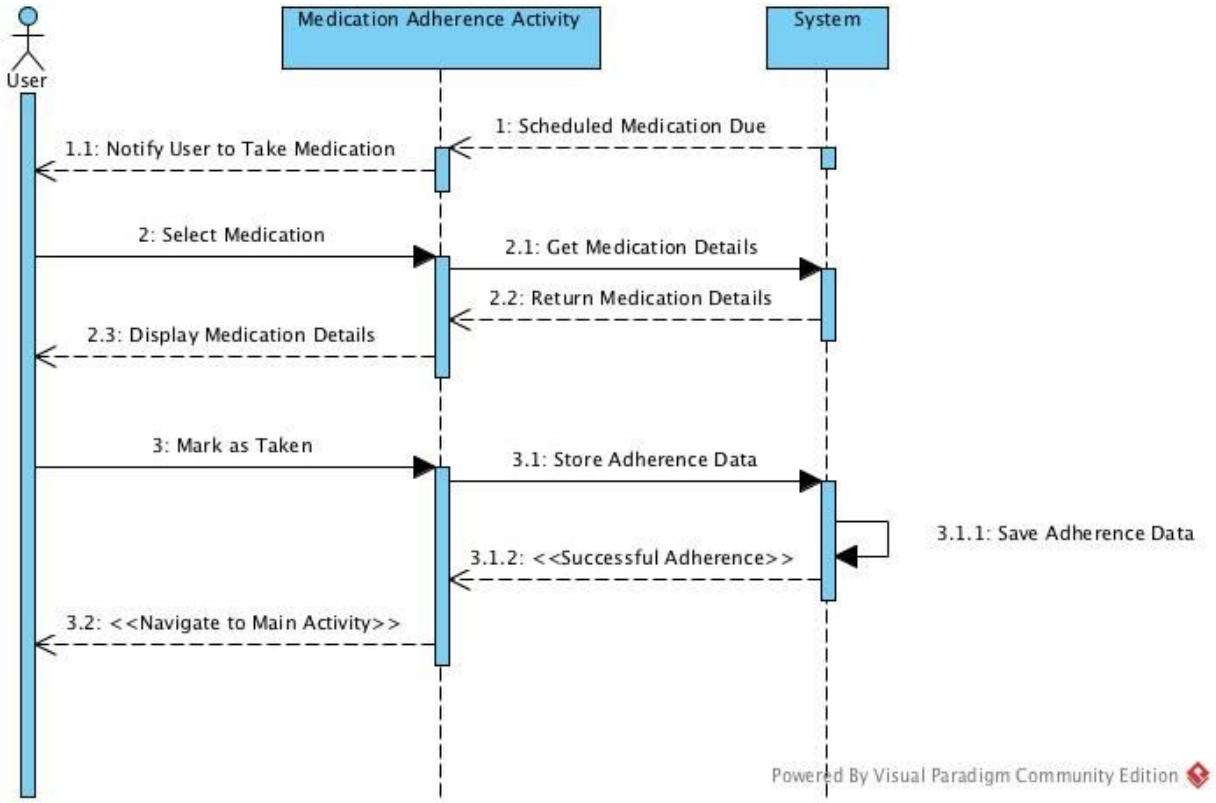
Add/Edit Medication

From the main screen, the user will be able to add a new medication. Once they do so, a screen will prompt them to enter the name of the medication and the schedule in which to take it. Then, they will take a picture of the medication and press "Save". If there's an error while saving, it will be displayed to the user. The user can also press "Cancel", which will close the activity. From the daily view, the user can click on a medication to edit it.



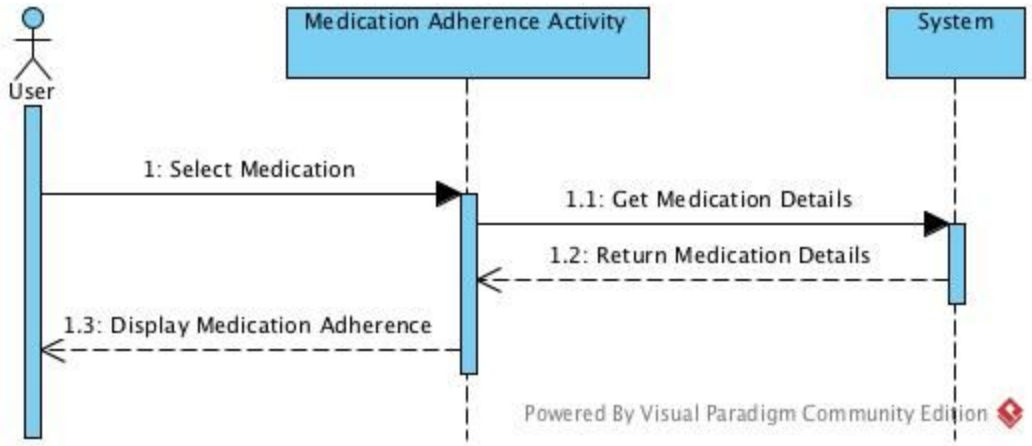
Mark Medication as Taken

The system notifies the user that a particular medication is due to be taken. Once the system has properly notified the user, the user then selects the medication and chooses whether or not they took the medication at the correct time. The medication adherence activity then tells the system to store the adherence data, whether it be taken or not taken, then the system saves the data in the database. As of now, once this process is complete the user will be automatically navigated to the main activity view.



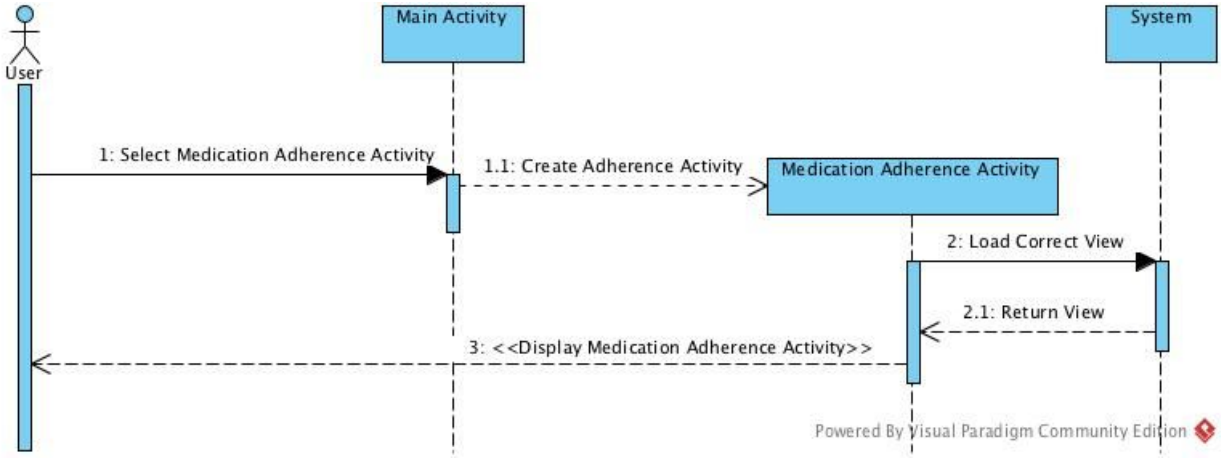
View Adherence By Medication

On the Medication Adherence Activity view, the user will be able to individually select a medication in order to view the medication's details, as well as to view the individual medication adherence chart. This sequence will be used in a similar vein to viewing the adherence chart for all medications for a week/month, however is useful for patients or doctors to see how they are taking one single medication.



View Adherence Overview

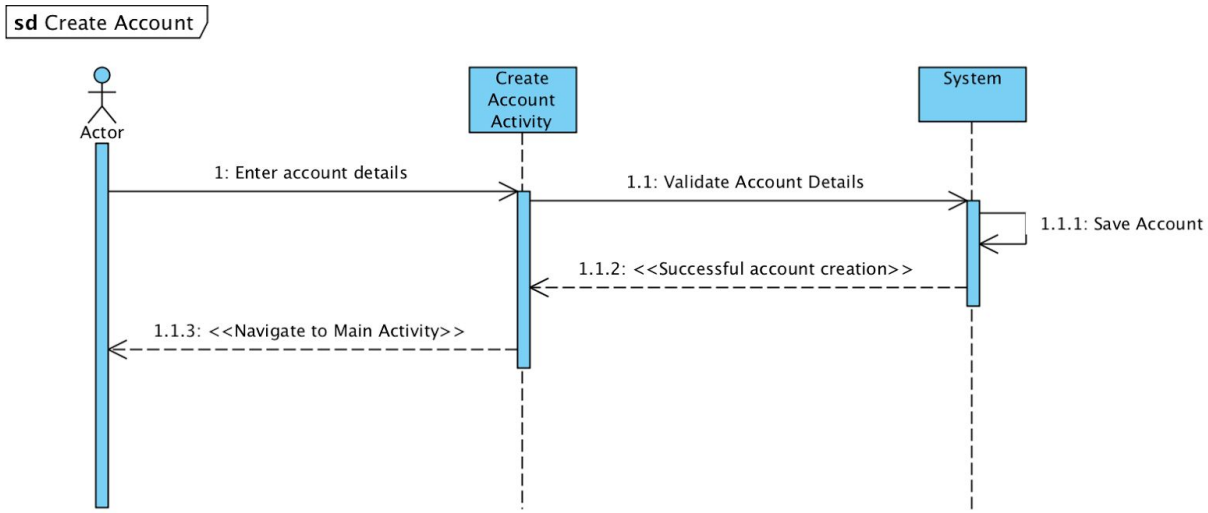
From the Main Activity view, a user will be able to click on an option to view the adherence chart for all medications. As soon as this sequence is begun, the adherence activity view will be created and will receive information from the system regarding the correct view (month or week) and will fill in all related medication data. Once the system completes this process, the medication adherence activity will display to the user.



Create Account

From the Sign-in/Create Account activity the user will select tap the “Create Account” button, which will navigate them to the Create Account activity. On this activity they will enter their email address,

password and their password again for confirmation. They will then select the “Submit” button. Once their account is validated and successfully created, they will be navigated to the Main Activity.

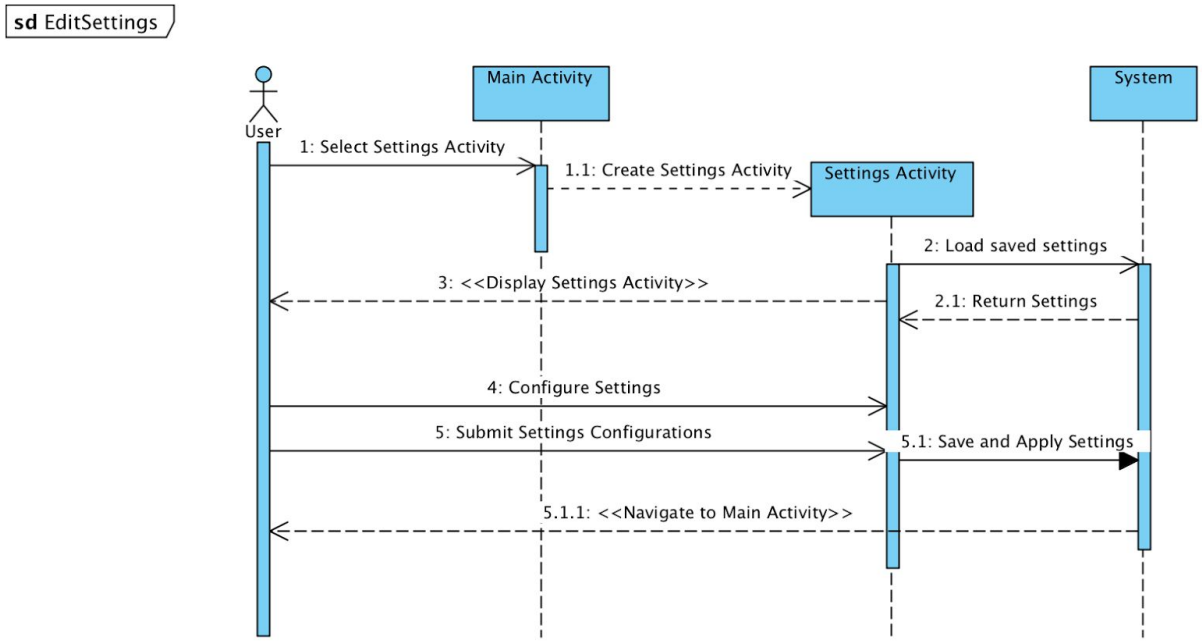


View/Edit Settings

From the main activity the user opens the settings by selecting the settings icon from the toolbar menu. Once the user has navigated to the settings activity, they will be able to view and edit the existing settings. The settings they will be able to configure are as follows:

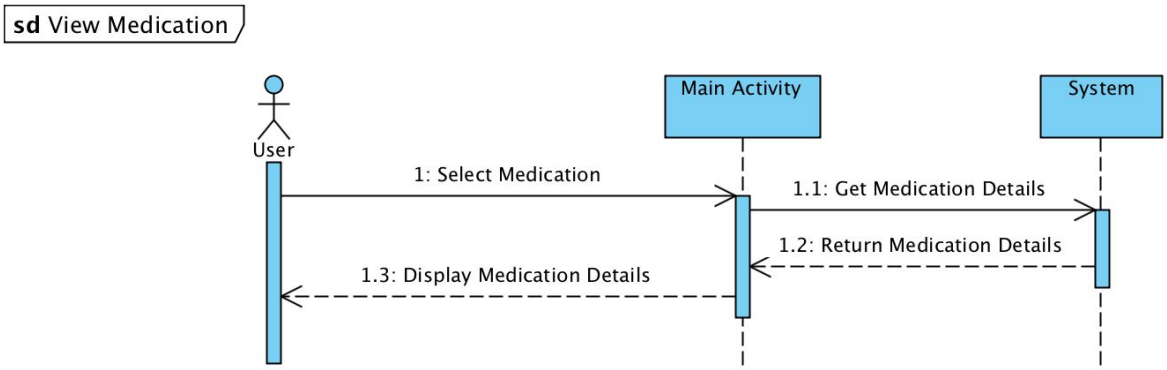
- The user will be able to change the snooze period. When the user is prompted to take a medication, they are given the “Remind Me” option. The snooze period is the amount of time that is between the user selecting “Remind Me” and when they will receive their next reminder. This option will be edited with a picker control
- The user will be able to change the accessibility settings which include text-size, text-to-speech, and speech-to-text. The text size change will be edited with a slider and the text-to-speech and speech-to-text settings will be toggled on or off using a toggle switch.
- The user will be able to edit their account settings. These settings include their email address and password.
- The user will be able to edit their health profile. This includes any medical conditions they have, contact information for their doctors and emergency contact information.

- The user will be able to view an “About “ section that includes information about the app, such as version info.



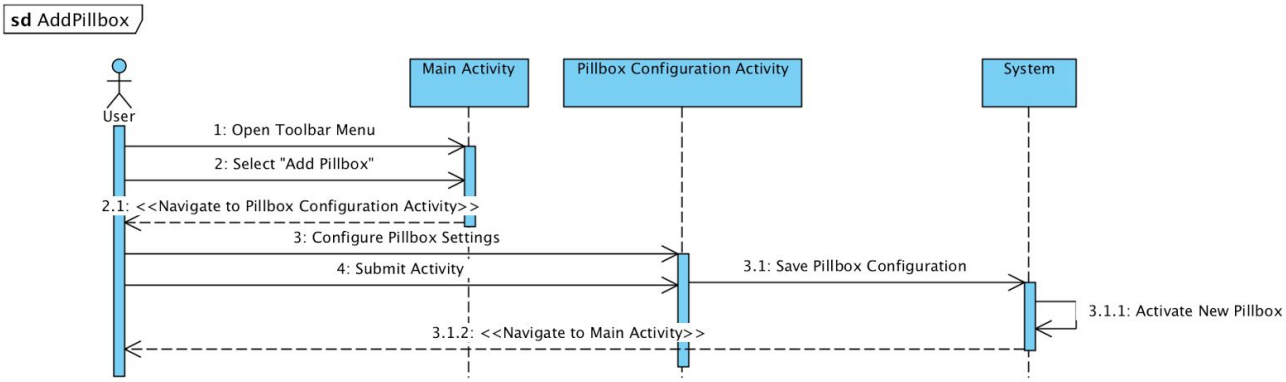
View Medication

From the daily view of the main activity, the user will be able to select a medication from their schedule. Once the medication is selected, the medication’s details will be retrieved from the database and the upper portion of the daily view will be populated with the medications details. These details include the medication’s name, a photo of the pill, side-effect (logged by the user), the dosage and the time that the pill is scheduled to be taken.



Add Pillbox

From the Main Activity the user opens the toolbar menu and selects “Add Pillbox”. This will navigate them to the Add Pillbox Activity. In the Add Pillbox Activity, the user will enter the configurations for their pillbox, and submit the configurations. Upon submission, the configurations of the pillbox will be saved, the new pillbox will become the active pillbox, and the application will return to the main activity.



Database Diagram

The database will consist of four main tables:

- Pillbox Header
- Medication
- User
- Status

Pillbox_Header will be the main driving table for the interface and will consist of the following attributes:

- User_id(int) Foreign Key
- Medication_id(int) Foreign Key
- Dosage(int)
- Date(datetime)
- Time(datetime)
- Active_Flag(varchar2(1))
- Status_Id(int) Foreign Key
- Header_Id(int) Unique Primary Key

Pillbox_Medicationr will contain information on the individual medications and will consist of the following attributes:

- Medication_Id(int) Unique Primary Key
- Medication_Name(varchar(150))
- Description(varchar(150))
- File_Location(varchar(150))
- Color?(varchar(150))
- Shape?(varchar(50))

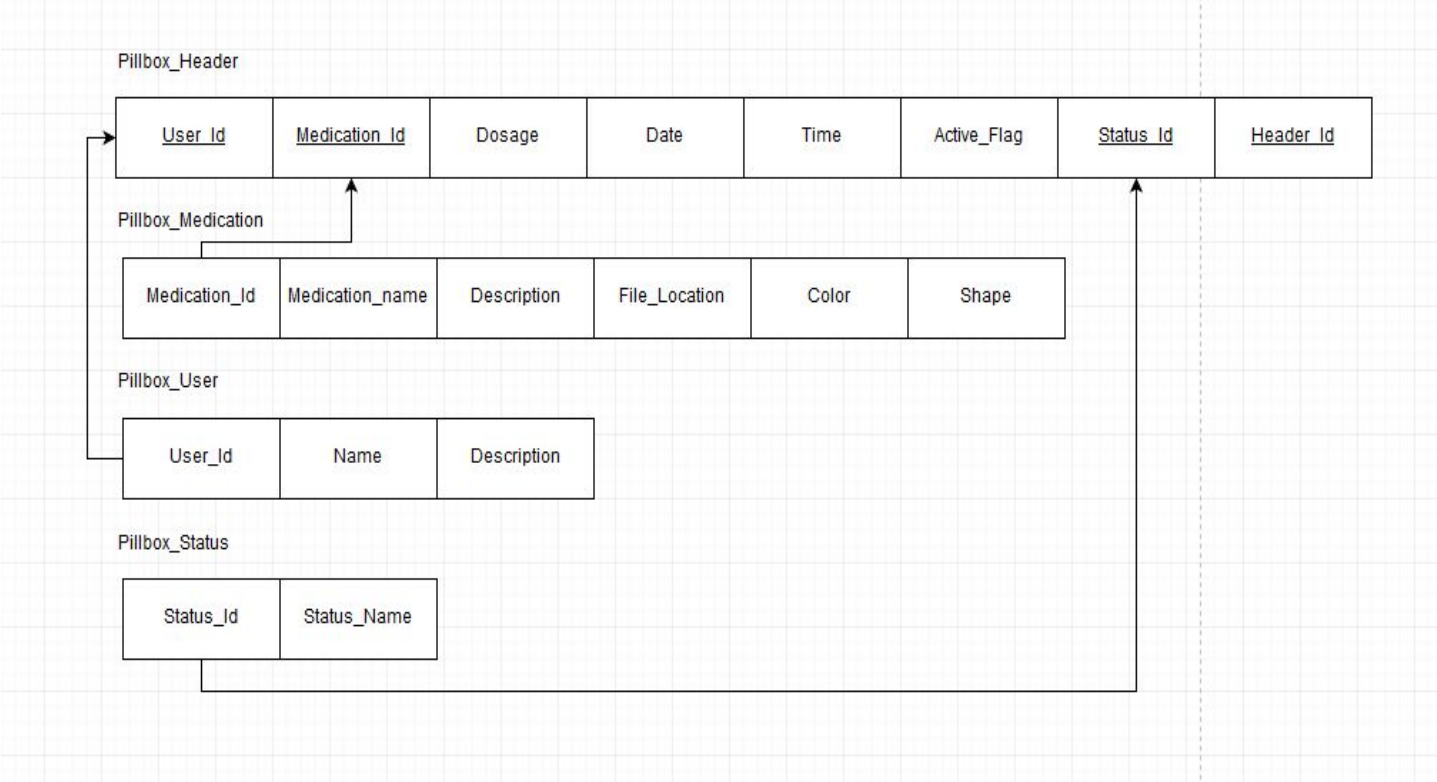
Pillbox_User will contain information on the individual users in the app and will consist of the following attributes:

- User_Id(int) Unique Primary Key
- Name(varchar(150))
- Description(varchar(150))

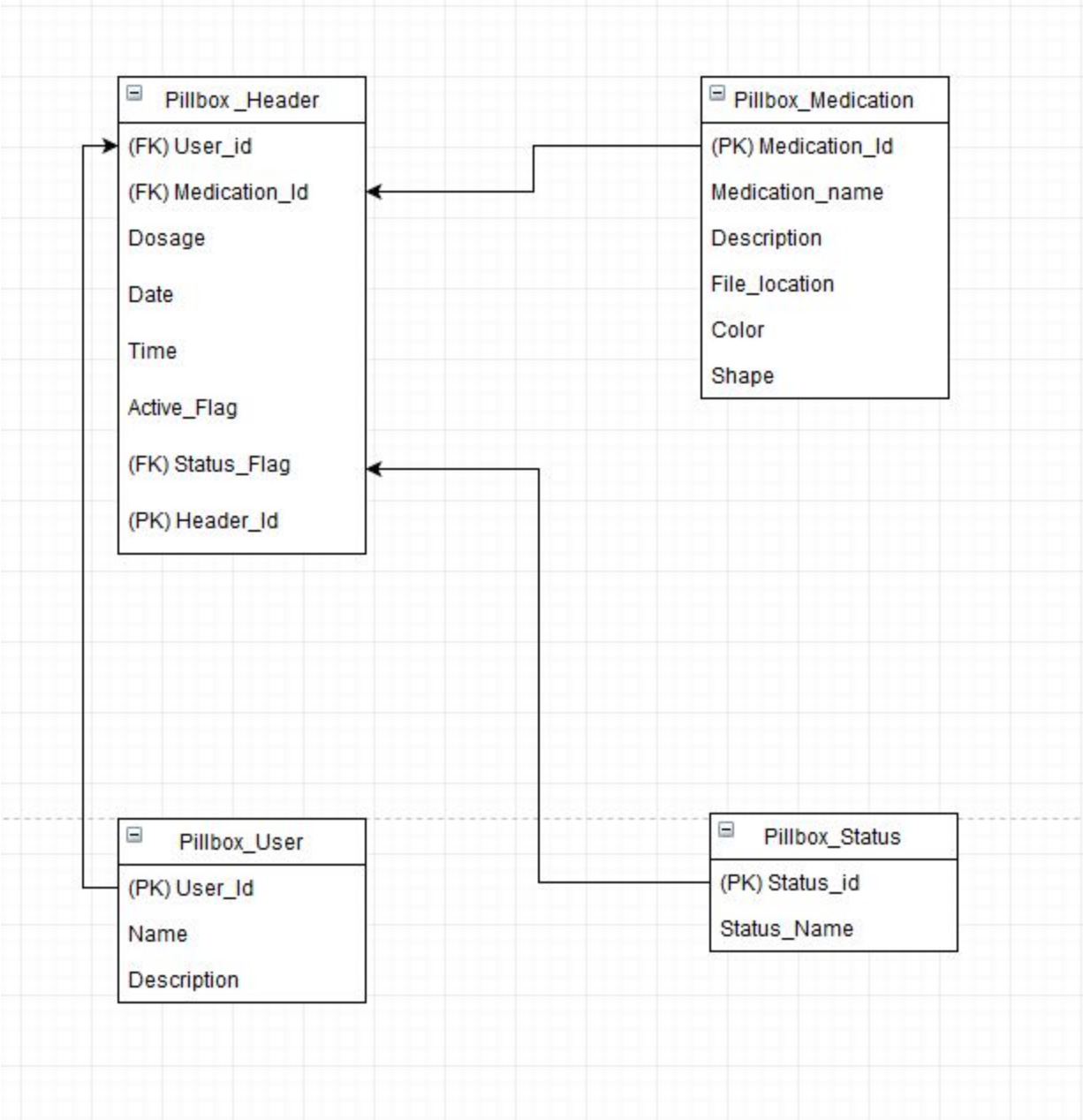
Pillbox_Status will contain the associated status to support the Header table and consist of these attributes:

- Staus_Id(int) Unique Primary Key
- Status_Name(varchar(50))

Database Schema

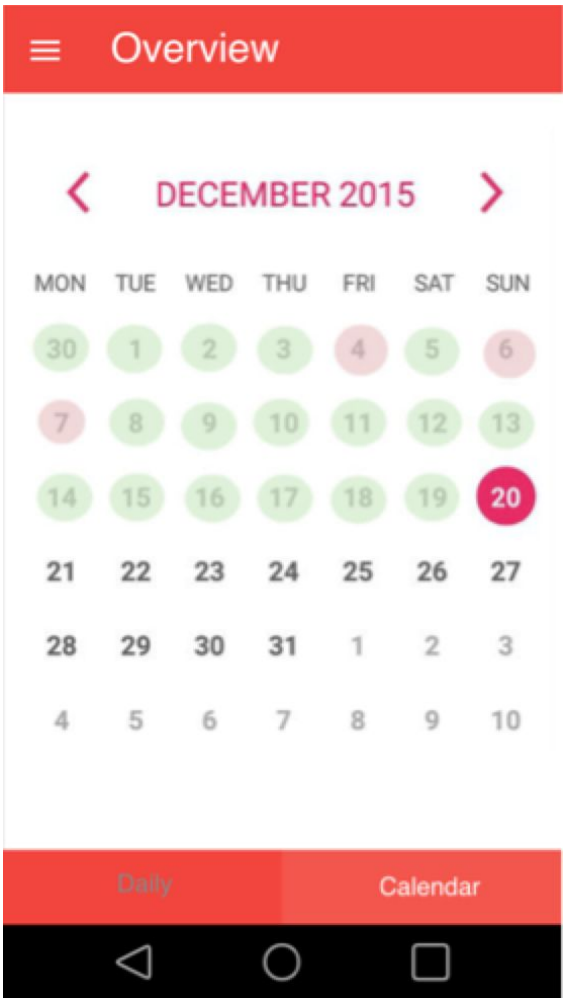


ER Diagram


Pillbox _Header
(FK) User_id
(FK) Medication_Id
Dosage
Date
Time
Active_Flag
(FK) Status_Flag
(PK) Header_Id
Pillbox_Medication
(PK) Medication_Id
Medication_name
Description
File_location
Color
Shape
Pillbox_User
(PK) User_Id
Name
Description
Pillbox_Status
(PK) Status_id
Status_Name

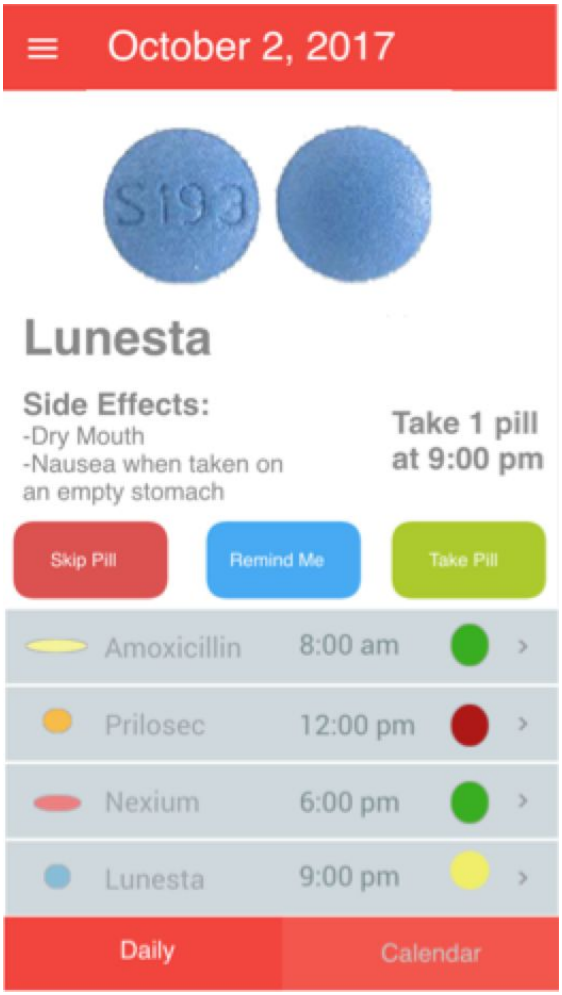
UI Mockups

Medication Adherence View



This UI mockup shows what we plan on creating as the Medication Adherence View. This view will be a calendar that is marked with green, yellow or red dots on the date in order to signify that a user has or has not taken their medications. The user will be able to scroll to past months to see previous medication adherence and has the ability to click on the current date in order to bring up a daily view of what medications they need to take.

Daily View



This UI mockup shows our plans for the daily view. The top portion of the mockup contains the picture of the pill, pill name and side effects that the patient has previously entered. It also details the numerical amount of pills to take and at what time they need to be taken. If a user clicks on a pill from the bottom portion of the screen, the new medication will show up on this top portion. Initially, the pill on top will be the next pill to take. In the middle of the screen, the patient has the ability to skip taking the pill for the day, take the pill or remind them to take the pill after a designated time period. The “remind me” button will be similar to a snooze button on an alarm clock and will notify the patient to take the medication again. The amount of time taken between pressing the button and notifying the patient will be able to be changed in the settings screen, however the default time will be fifteen minutes. Finally, the bottom portion of the screen shows what pills are taken every day. A small thumbnail of the pill will be located on the far left side, followed by the name, time taken and a visual representation of whether or not they have taken the pill today.