University of Glasgow | School of Computing Science

Android Prescription Management System

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Level 4 Individual Project

Contents

1. Background
2. Requirements
3. Design
4. Implementation
5. Evaluation

Background – Medication Adherence

According to the World Health Organisation, medication adherence is a global problem which leads to increased mortality rates.

Studies have shown that there is an inverse relationship between the frequency of medication doses and rates of medication adherence

This puts patients who are suffering from chronic illness to be at increased risk of failing to adhere to their medication

Background – Medication Adherence

Medication nonadherence is usually down to involuntary causes such as simple forgetfulness.

The act of remembering to do tasks in the future is a function of prospective memory, which is an ability that declines with age

A traditional method to circumvent forgetfulness of taking medication is the pillbox

Background – Reminder Apps

A modern method of remembering to perform tasks is the usage of reminder apps on mobile devices, that can send notifications to the user

This can be generalised for a medication reminder system on a user's mobile device

These have been proven to be more effective in the case of enforcing medication adherence than pillboxes

Background – Google Calendar

Calendars are used to support prospective memory, serving as a tool that people can refer to for future events.

Online calendars have the benefit over physical calendars as they can be accessed across multiple devices.

Google Calendar is one of the most popular online calendar services, with 25% of mobile calendar users using it.

Studies have shown that using Google Calendar helps increase the performance of prospective memory

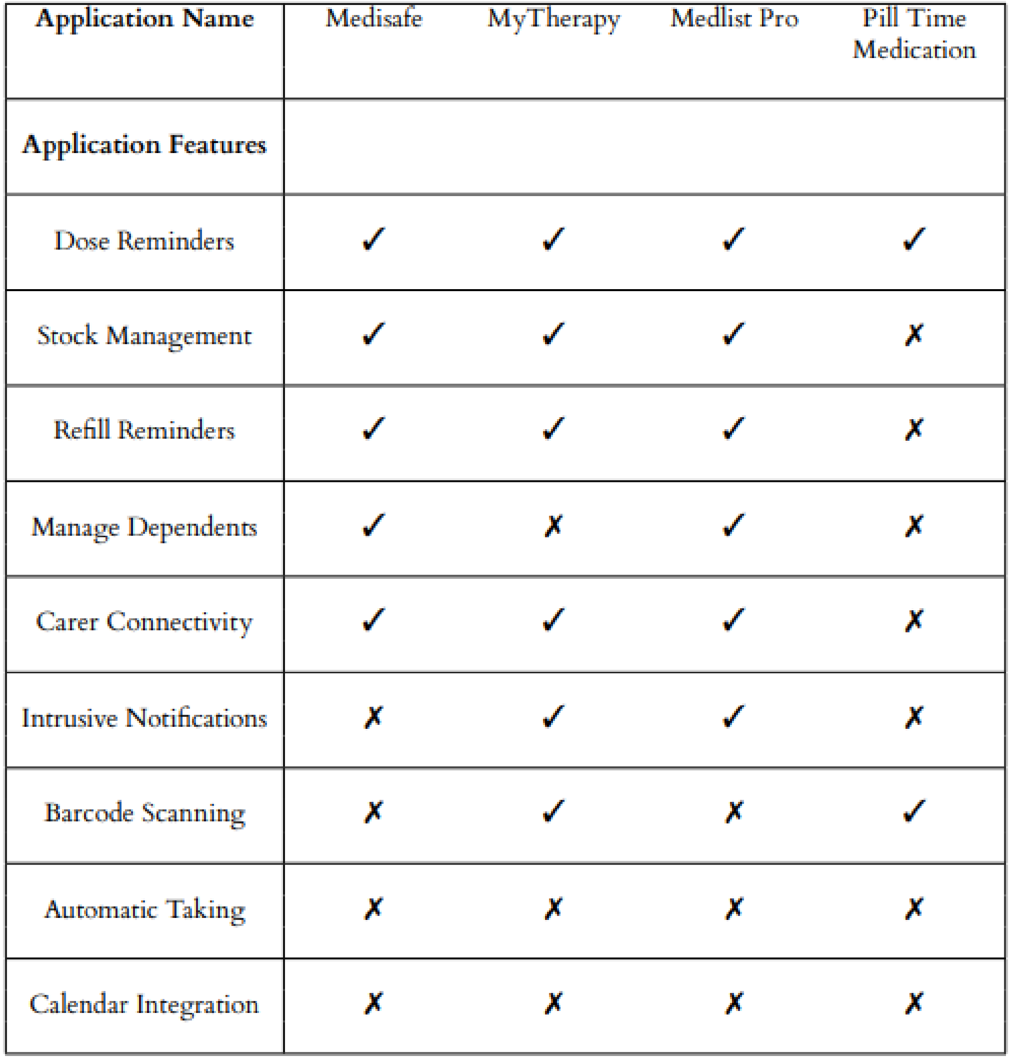
Idea

A prescription management system on a mobile device that can interface with a user’s Google Calendar can lead to increased performance in prospective memory, and thus lead to greater rates of medication adherence.

Existing Apps

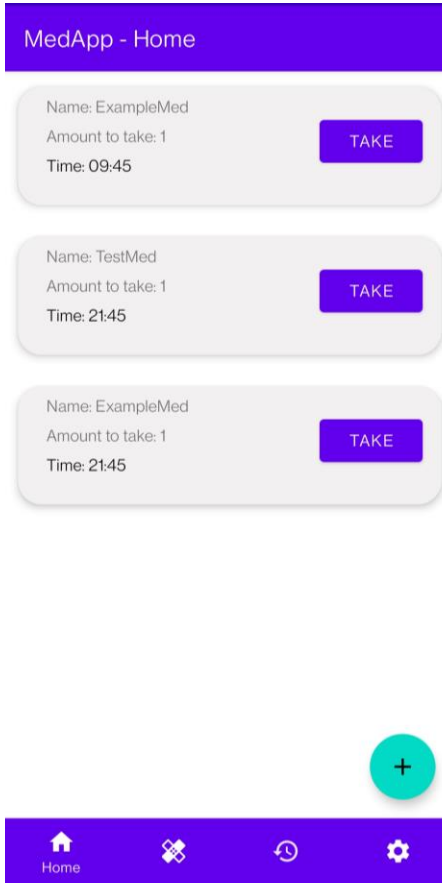
- Four apps were looked at and their features were identified
- No app in the Play Store has the functionality to synchronise with an online calendar system

Table 2.1: Table that asserts the functionality that existing prescription management apps have



Application Name	Medisafe	MyTherapy	Medlist Pro	Pill Time Medication
Application Features				
Dose Reminders	✓	✓	✓	✓
Stock Management	✓	✓	✓	✗
Refill Reminders	✓	✓	✓	✗
Manage Dependents	✓	✗	✓	✗
Carer Connectivity	✓	✓	✓	✗
Intrusive Notifications	✗	✓	✓	✗
Barcode Scanning	✗	✓	✗	✓
Automatic Taking	✗	✗	✗	✗
Calendar Integration	✗	✗	✗	✗

User Interface - Final

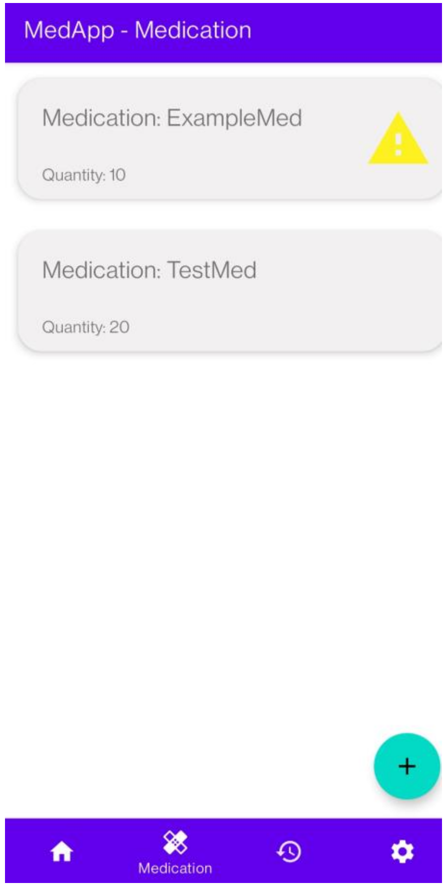


MedApp - Home

Name: ExampleMed
Amount to take: 1
Time: 09:45

Name: TestMed
Amount to take: 1
Time: 21:45

Name: ExampleMed
Amount to take: 1
Time: 21:45

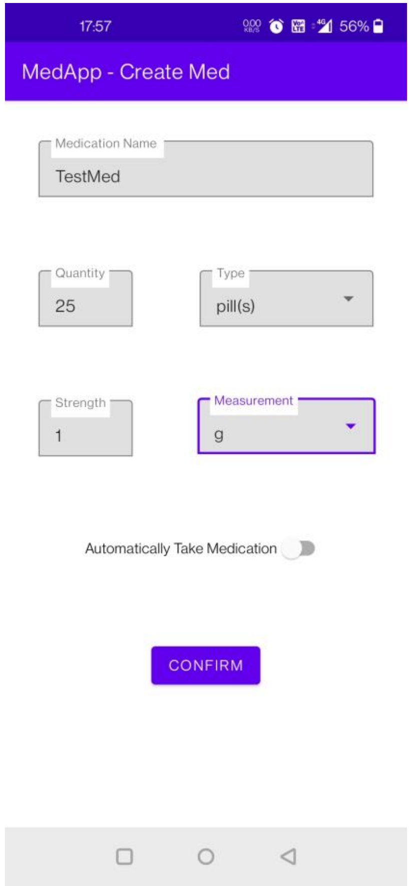


MedApp - Medication

Medication: ExampleMed
Quantity: 10

Medication: TestMed
Quantity: 20

User Interface - Final



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MedApp - Create Med

Medication Name: TestMed

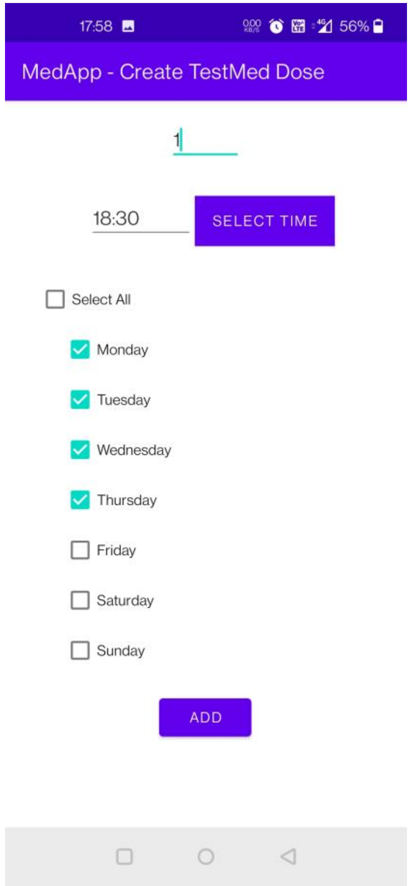
Quantity: 25

Type: pill(s)

Strength: 1

Measurement: g

Automatically Take Medication



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MedApp - Create TestMed Dose

1

18:30

☐ Select All

☑ Monday

☑ Tuesday

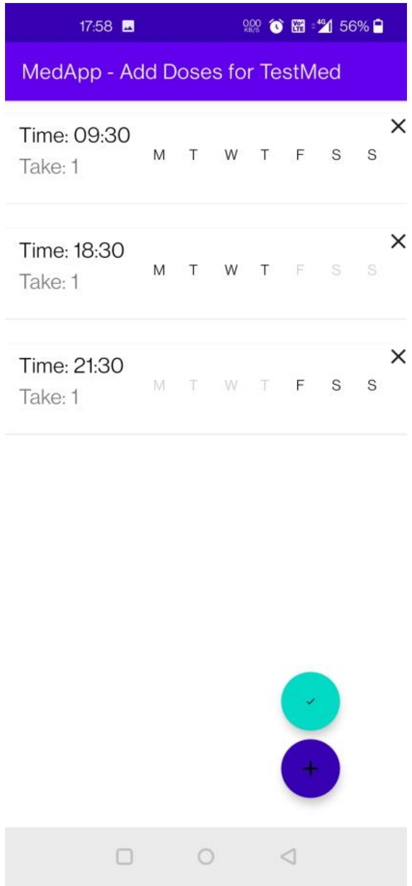
☑ Wednesday

☑ Thursday

☐ Friday

☐ Saturday

☐ Sunday



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MedApp - Add Doses for TestMed

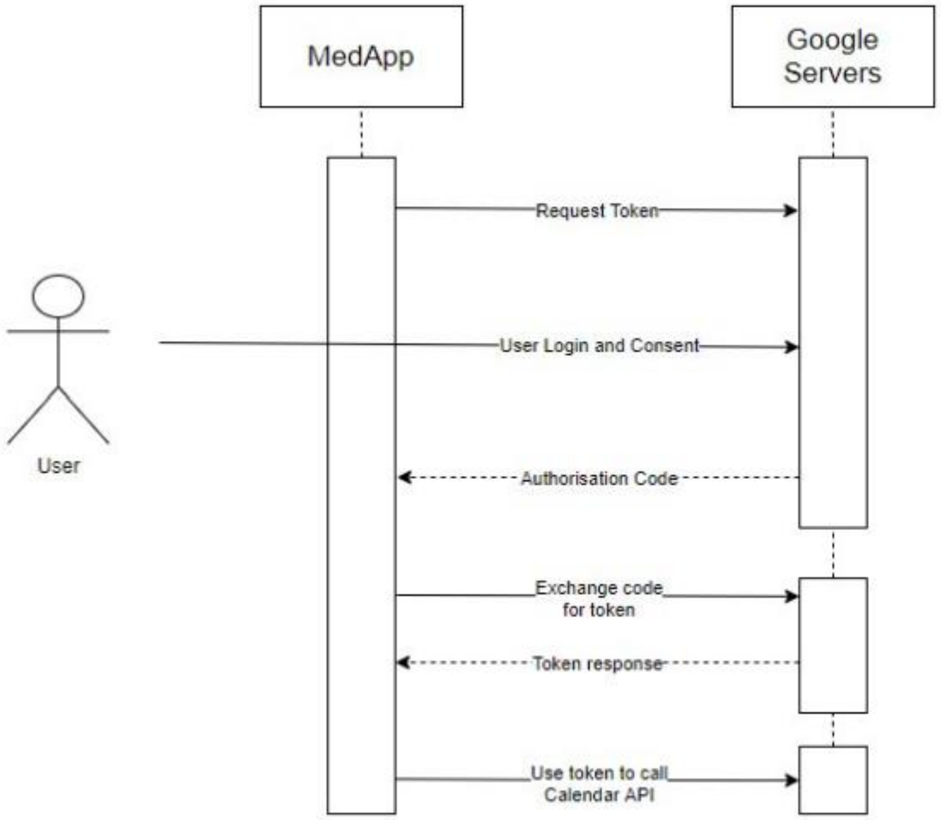
Time: 09:30 M T W T F S S
Take: 1

Time: 18:30 M T W T F S S
Take: 1

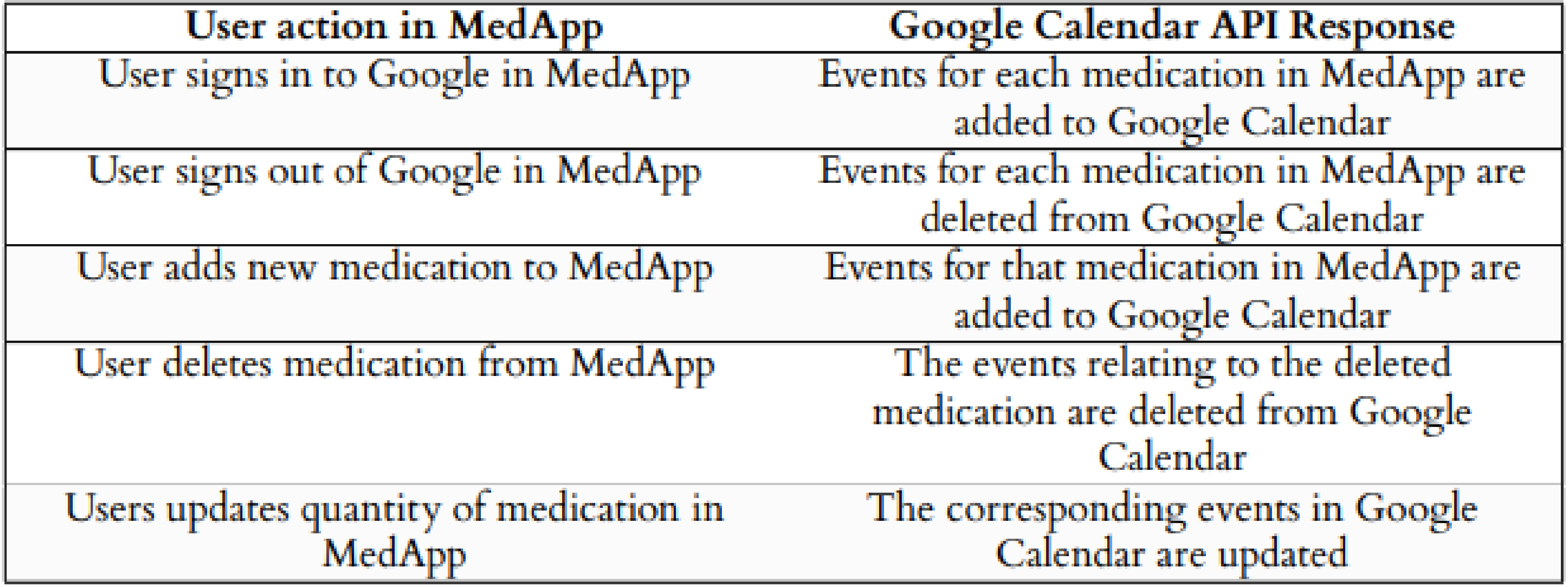
Time: 21:30 M T W T F S S
Take: 1

Google Calendar API - Design

- To be able to interface with Google Calendar, MedApp must use the Google Calendar API.
- This API makes use of the OAuth 2.0 authentication protocol to authenticate and authorise Google users, without the app receiving or knowing any details about who the user is



Google Calendar API



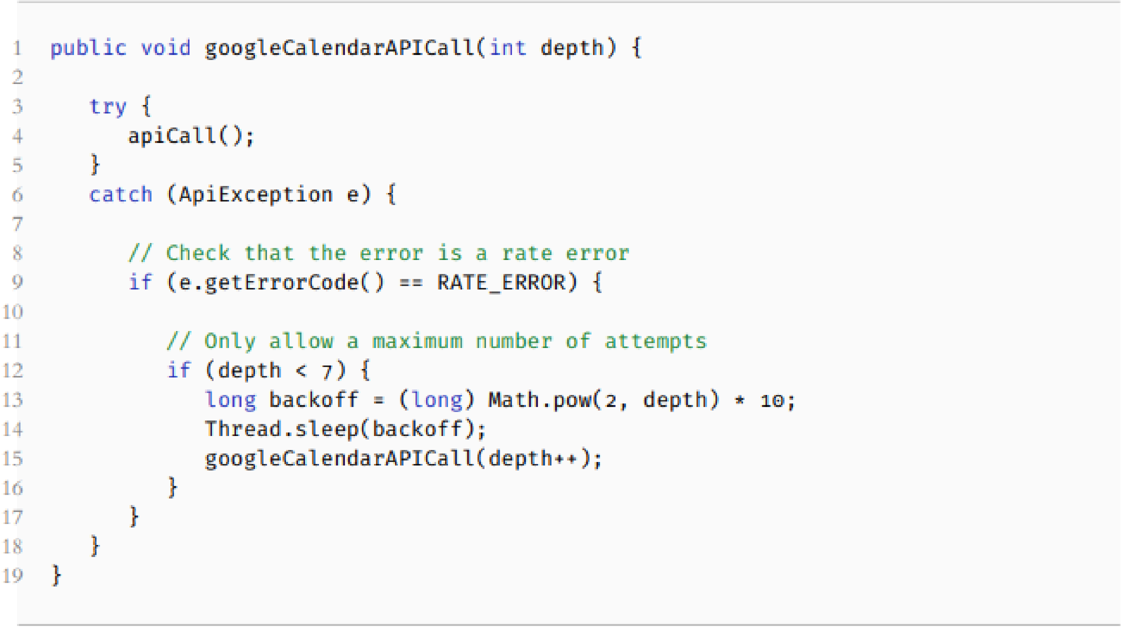
User action in MedApp	Google Calendar API Response
User signs in to Google in MedApp	Events for each medication in MedApp are added to Google Calendar
User signs out of Google in MedApp	Events for each medication in MedApp are deleted from Google Calendar
User adds new medication to MedApp	Events for that medication in MedApp are added to Google Calendar
User deletes medication from MedApp	The events relating to the deleted medication are deleted from Google Calendar
Users updates quantity of medication in MedApp	The corresponding events in Google Calendar are updated

Scheduling Events

- Events can be scheduled in MedApp by using the system alarm and Android Studio’s BroadcastReceivers
- I.e. using AlarmManager to define a certain time to send a message to a receiver to execute code
- This is used for:
  - Daily events in the app (e.g. resetting the “isTaken” field of doses so that they can be taken again
  - Dose reminders (e.g. alarm set for the time the dose is to be taken so that the notification is sent to the user at this time
  - Refill reminders (e.g. alarm set on days where the medication is low on stock and needs a refill)

Google Calendar API

- When too many requests were happening at once, the API would encounter rate errors and fail to add or delete events accordingly
- Exponential backoff algorithm was implemented for API requests in order to resolve this



```
public void googleCalendarAPICall(int depth) {

   try {
      apiCall();
   }
   catch (ApiException e) {

      // Check that the error is a rate error
      if (e.getErrorCode() == RATE_ERROR) {

         // Only allow a maximum number of attempts
         if (depth < 7) {
            long backoff = (long) Math.pow(2, depth) * 10;
            Thread.sleep(backoff);
            googleCalendarAPICall(depth++);
         }
      }
   }
}
```

Thank you for watching!