# The Design and Implementation of a Mobile Prescription System

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*Abstract— In this paper, a mobile prescription reminder and scheduling system application is designed and implemented. By using the application, users are able to create and manage prescriptions and are reminded to take the medication based on the prescription data. Besides, users are able to reach the prospectuses of the drugs. Since the medicine compliance is very important to have an effective treatment, the main goal of this application is to help people to take their medicines on time and find the prospectus information of the drugs easily by using their mobile phones.*

*Index Terms— iOS, Medicine Compliance, Mobile Application, Smartphone*

## I. INTRODUCTION

In the last decade, smartphones have started to occupy a significant place in our daily lives. Their huge ecosystem brings us various mobile applications that make the smartphones unique and user-centric. Mobile healthcare applications have an important place in this ecosystem. A significant number of mobile healthcare applications are developed with a motivation to make a patient's life easier.

One of the most important problems that can be observed during the patient treatment process is poor medication compliance. Patients generally resist taking their medicines as directed by their doctors [1]. For the patients with chronic diseases, medication compliance is very important and can be vital. Following the prescription indications such as sequence, dosage and time can make the difference between a fast recovery of a patient and a long, costly treatment and even possible hospitalization or death [2].

Mobile applications in the marketplaces generally provide limited functionality. It is easy to find various applications which provide prospectus information about drugs. It is also easy to find applications which serve as a drug reminder. However, there is a lack of applications which serve as both a drug database and a drug reminder system.

In this paper, a mobile application "Medicine Reminder" is described. The main motivation of the "Medicine Reminder" application is to provide users to have an application that assists them to have their treatment on a regular basis.

"Medicine Reminder" makes it possible for a patient to find prospectus information of a drug; besides, it provides an infrastructure where the users can create prescriptions online.

"Medicine Reminder" records the medicine usage behaviors of the users so that the users can monitor their medicine compliance. By using this application, it is aimed to encourage people to take their medicines on time. The rest of the paper is organized as follows: Section 2 describes the system architecture for "Medicine Reminder". Section 3 provides the functionalities of the application briefly. Finally, the paper concludes with the Conclusions section.

## II. SYSTEM ARCHITECTURE

### A. Overview

"Medicine Reminder" has two main components. The client and the server sides as illustrated in Fig. 1. "Medicine Reminder" is a native iOS application which lets users to interact with the system by using their Apple smartphones. Besides, SQLite serves as a database management system on the client side. A remote web server forms the server side component. MySQL serves as a database management system on the server side and the PHP Web Service Application Program Interface (API) helps to handle the requests from the client side.

### B. Database Design

In the application, two different database management systems are used to store the data such as prospectuses, user information and medicine information.

One of them is the local database of the smartphone. iOS contains the SQLite library, which is a lightweight relational database engine. Therefore, SQLite database management system is used to store and manage the data. Since using the local database promises an always available, fast, secure and network connection independent database, some of the functionalities, which do not contain user specific information and requiring relatively better performance, are handled through the local database of the mobile device.

The other database management system which is used at the remote server side is MySQL which is one of the most popular open source databases in the world. All the application and user specific data are stored in the remote database and the data is reached through web services by the client. This makes "Medicine Reminder" device independent since the user can use his credentials with any Apple mobile device to see his details.

### C. Client Side

iOS is the operating system that runs on iPad, iPhone, and iPod touch devices. The operating system manages the device hardware and provides the technologies required to implement native apps [3].

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There are several languages that can be used to develop an iOS application such as Objective-C and Swift. The "Medicine Reminder" application is implemented as a native iOS application by using Objective-C language. Objective-C is an object oriented programming language which is built on top of the C programming language. The developer can use Xcode to implement an iOS mobile application with Objective-C. XCode is the Integrated Development Environment (IDE) of Apple and it comes with the iOS SDK (Software Development Kit) which is a must have to develop a native iOS mobile application.

### D. Client-Server Communication

To establish the connection between the mobile application and the remote server, PHP scripts that contain web services are used as an abstraction layer. "Medicine Reminder" application basically sends https request to the PHP web service. Then, the PHP script connects to the database so that it can query the database for the requested data and returns the result to the iPhone application in JSON (JavaScript Object Notation) format. The data that is retrieved in JSON format can be easily parsed and converted into native Objective-C objects, then used in the client side. In addition, it is also possible to do "insert", "update" and "delete" operations. The PHP script at the server side uses the data, which is sent with the request and executes the necessary SQL (Structured Query Language) statements to manipulate the database tables.

In conclusion, in the server side there are PHP scripts that contain several web service methods. The request is sent to a PHP script from the iPhone application and the PHP web services are used to access the database to be able to execute the necessary operations. Then, the JSON response received from the web service is consumed at the client side.

### III. FUNCTIONALITIES OF THE MEDICINE REMINDER

The "Medicine Reminder" mobile application is designed and implemented for the iOS platform. All the functionalities mentioned below are implemented and tested successfully for various Apple mobile devices including iPhone 4, iPhone 5s, iPhone 6 and iPad 4.

### A. Registration

To use all the functionalities of the application, users should be registered. Users should provide details such as name, surname, e-mail, phone number, username and password for registration.

### B. User Login

From the main screen, user can press the user login button and enter the username and password to log in to the system. If the user does not remember his password, he can use "password recovery" function and enter his e-mail so that he can recover his account.
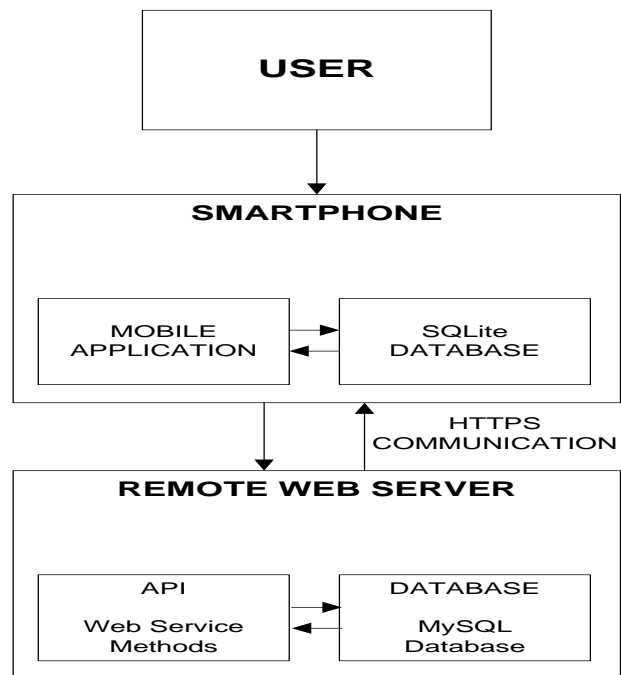


**Fig. 1. System architecture**

### C. Find Prospectus Information of a Drug

In this section, the user can see a search bar and a list of drugs. The list of drugs comes from the local SQLite database for the sake of performance improvement. The user can use the search bar to find a specific drug. Since the drug information is stored in the local database, the performance of the search result is very satisfactory. When the user finds the drug he can press on it to see further details such as formula, indications, contraindications, warnings, side effects, usage and so on. User can see all the information about the drug hence, this information comes from the remote server.

### D. Create a New Prescription

The user gives prescription details to create a prescription in this part. Each prescription contains at least one drug and the user gives the usage details for the drug(s) stored in the prescription.

For each prescription item in the prescription, user provides drug name, on-a-full-stomach information, quantity in the box (optional), dosage, start time, end time (optional), medication interval and drug photo (optional).

After completing the prescription, user presses the save button to send the prescription configuration to the server. As a result of this operation, the prescription is saved for that specific user. Additionally, local notifications are also set to remind medication times to the user. Local notifications are used to notify the users by enabling the application that is not running in the foreground to let its users know the application has information for the user [4].

Local notifications are scheduled and sent by the application itself, there is no need to have an internet connection, thus the application is reliable.

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Even if the user is not logged in or does not have an internet connection, the user can get the medication reminder notification, since the local notifications are already set during the prescription creation process.

### E. Today's Drugs

Today's Drugs functionality has two important roles. One of them is to show users what drugs will be taken on that day, the other one is to let users to record their medicine taking activity.

Today's Drugs serves as an informative screen so that the user can see what kind of medicines will be taken on that day. Additionally, there is a checkbox next to each item which represents the usage status of the item. The user must select this checkbox after using the related medicine so that his medicine usage behavior can be tracked. The only constraint is that the user must select the checkbox before midnight, because after midnight, Today's Drugs list will be refreshed for the next day.

Today's Drugs is a key element of the application. If the user does not select the checkbox after using the medicine, it is impossible to have an insight about the user's medicine compliance.

### F. Prescription List

Prescription list lets the user to see all the active prescriptions in a list. It is possible to see the details of the prescription. Additionally, it is also possible to edit or delete an existing prescription.

### G. Settings

Settings menu gives the ability to change user details such as email, phone number and password. The user can also turn on/off the notification service from the Settings menu.

## IV. CONCLUSIONS

Taking medicines on time and as directed is really important for an efficient treatment method for the patients. Especially for the chronic illnesses, medicine compliance plays a key role in the treatment process. Unfortunately, the number of people who has poor medicine compliance is extremely high.

In this paper, a mobile healthcare application "Medicine Reminder" is developed and described. "Medicine Reminder" is a mobile prescription reminder and scheduling system and it provides an online infrastructure. "Medicine Reminder" lets users to find prospectus information of drugs, create and manage prescriptions and get notifications for the medication schedules. By creating such environment, "Medicine Reminder" aims to encourage people to take their medicines on time to get an effective treatment.

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