Keeping Up with Healthcare Trends: IcHeart as a Medication Management Application

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Abstract. According to the US governments, more than 125,000 people die each year due to failure to manage their medications, leading to approximately USD100 billion in preventable costs to healthcare systems. The core failure in medication management is attributed by patients failing to adhere their medication regimens, whether by accident, negligence, or intentional. Recognizing the important of vigilant monitoring in medication management, this paper is set to review the latest android-based healthcare trends and propose a new mobile medication reminder application called IcHeart.

1. Introduction

According to the medical dictionary by Medilexicon (http://www.medilexicon.com/medicaldictionary.php), medicine is a practice of preventing or curing diseases that affect the internal parts of the body, especially those not usually requiring surgical intervention. Medicines can be in many forms such as pills vs. tablets, capsules, injection, liquids vs. syrups, lozenges, inhalants, creams vs. ointments, suppositories, aerosol and pessary. The functioning of a medicine highly relies on the effectiveness of dosing and administration of the medication such as what time should take the drug, how many time to take drug per day and what route of administration gives the most effective result.

Medication management is the monitoring of medications a patient takes to confirm the patient is adhering to a medication regimen, while also ensuring the patient is avoiding potentially dangerous drug interactions and other complications. Due to its importance, numerous devices and system applications have been developed for of medication management to
help people especially the elderly patients keep track of their medications. There are three levels of medications management: simple reminder, reminder plus dispenser and reminder, dispenser and monitor. The device for pill organization, for example, comes in various forms from a cheap compartment to the very sophisticated pill reminding or dispensing system with visual and sounding alarms.

Recognizing the importance of vigilant monitoring in medication management, this paper is set to review the latest android-based healthcare trends and propose a mobile medication reminder application named IcHeart. Android-based or mobile applications are gaining popularity day by day as the number of smartphone users worldwide is expected to exceed more than 2 billion people in 2016 and continue to grow to more than 2.6 million people in 2018 [3] (refer Figure 1). The catalyst to the exponential increase is due to the technology in the smartphone itself, being multi-functional from a camera and web browser to a high-density display. The capacity has also been increasing, whereby smartphones are equipped with powerful operating system, processors, large storage space for higher memory space in storing data.

![Figure 1. A graph showing the increasing number of smartphone users](http://www.statista.com/statistics/201182/forecast-of-smartphone-users-in-the-us/)

According a Compuware report, 85% of users prefer android-based or mobile applications over websites because the prior is more convenient, faster and easier to browse [4] (refer Figure 2). The remainder of this paper is organized as follows. Section 2 presents a review of existing medication reminder applications, followed by future plan of a new medication reminder application called IcHeart in Section 3.

2. Review of applications
This paper will review three most popular medication reminder applications, two of which have the same name. The applications are Pill Reminder, Medicine Reminder, and Pill Reminder. The reviews will be based on functionalities and key selling points of each application.

2.1. Pill reminder
Pill reminder is a very simple medication application that does only one thing; to remind users their pills intake. The set alarm interface is clear and neat. Users may set preferences to this
Figure 2. Benefit of mobile apps vs. mobile websites (https://econsultancy.com/blog/62326-85-of-consumers-favour-apps-over-mobile-websites/)

application that specify the frequency of alarm and the reminder, the sound of alarm, as well as selection of light and vibration. Nonetheless, despite being easy to use, the functionalities of this application is very limited and users may opt setting alarm in a standard smartphone setting. There is also no room for keeping track of the medication details such as the intake regime as well as the dosage. Therefore, the user does not know the details of medicines to take, which gives problem to users with multiple medicine regime. Figure 3 shows the interfaces of the application.

Figure 3. Interfaces for Pill Reminder.

One useful feature in this application is the daily reminder with a pop-up message “Did you take today’s pill?”. The user may respond ‘Yes’, ‘Reminder me later’ or ‘Don’t need today’. This reminder is convenient as users may set off the alarm when it is due.

2.2. Medicine reminder
Medicine Reminder is another medication reminder application with 5-star rating in Google Playstore. The interface, as shown in Figure 4, uses images to represent morning, afternoon, evening, and night. The interface design is very intuitive, whereby the use of images bring convenience and easy understanding among users as people relates easily to time space rather than specific hours. One key feature in medicine reminder is the functionality to record details of the medicine such as the medicine name, description, dosage (in mg), medicine type and reminder
times. Therefore, when the alarm sets off, it will show the medicine name, dosage and type.

![Figure 4. Interfaces for Medicine Reminder.](image)

### 2.3. Pill reminder

This application, albeit the same name with the first reviewed application, has more commercial values. Pill Reminder supports multi-users, therefore is convenient for a user who is taking care medication for more than one person. The reminder for individual patient may be personalized with unique ringtone as well as vibration style. Figure 5 shows the interfaces of Pill Reminder application.

![Figure 5. Interfaces for Pill Reminder.](image)

This application, albeit the same name with the first reviewed application, has more commercial values. Pill Reminder supports multi-users, therefore is convenient for a user who is taking care medication for more than one person. The reminder for individual patient may be personalized with unique ringtone as well as vibration style. Based on user reviews, the only down point to this application is the design, which are not suitable for elderly patients.
3. Proposed medication reminder application
In helping the public to manage their medication, this paper proposes yet another medicine reminder application called I-cHeart, which is based on alarm system. Smartphone is the closest device to a person, and a medication alarm does not appear intrusive to the smartphone users. The alarm has to be set in advance and may be customized following the patient’s preference.

3.1. Requirements elicitation
Before the development work begins, requirements elicitation was carried out by distributing requirements questionnaire to potential users. The requirements questionnaire lists out questions about the application requirements, organized by proposed functionalities in the application. The objectives of the requirements questionnaire are as follows:

- To find out whether the respondents are interested in medication reminder application.
- To find out whether the respondents are using the similar application.
- To find out how respondents think about the importance of using a medicine reminder application.
- To find out whether the respondents can recognize the type of medicine.
- To find out the respondent is a chronically ill patient or otherwise in order to assess whether they need the need the application.
- To know whether the respondent has a regular medical check-up in order to assess the need of appointment functions.
- To design features that are important and useful for users.
- To find out the majority type of users, whether novice, intermediate or expert users.
- To figure out what respondent think about the benefits after using this application.

The results from the requirements questionnaire show that 85% of respondents who are not in good health conditions would use the proposed application. 80% of them do not has any medication reminder mechanism to help them manage their medicines. 40% of the respondents strongly believe that the application is necessary because 70% of the respondents are not able to recognize different types of medicines. In addition, 63.2% of the respondents do not have a regular medical check-up. The remaining 36.8% who has the routine, perform their medical check-up once a year (75%) or once every six months (25%). Next, Figure 6, Figure 7, and Figure 8 show the finding for the functionality requirement elicitation.

![Figure 6. Function: Medicine box (Add medicine details)](image)

Note that all the features will be included in the proposed medication reminder application, which are the medicine box (add medicine details), the schedule function (record of medicine taken in days) as well clinic (appointments, symptoms, case history and doctor details).
3.2. Prototype development

Development of IcHeart medication reminder application will be based on android operating system and programmed in Java with Android Studio Integrated Development Environment (IDE). The database management system used will be the Microsoft SQL Server together with Android API as libraries. Figure 9 shows the prototype interfaces of IcHeart application.

![Figure 9. Main interfaces for IcHeart medication reminder application.](image)

The main input to the medication reminder application would be the medicine itself, which include the name, type, description, dosage and administration schedule together with the details of the medical expert such as doctor or physician who prescribed the medicine. One additional feature of this application is the calendar note system, which is important for setting appointment and keeping detailed history of appointments. Symptoms is a minor functionality that provides a book note function for users to record irregularities in their health so all the symptoms can be presented to the doctor when an appointment is due.
Figure 10 shows the main functionalities in the IcHeart application.

![IcHeart Application Screenshots]

**Figure 10.** Functionalities of IcHeart medication reminder application.

4. Conclusions
IcHeart application is hoped to help patients to incorporate their medication management responsibility into their smartphone-friendly lifestyle through its dual functionality as reminder for medication as well medical appointments. IcHeart is therefore hoped to improve the overall health quality in the long run.

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