

Medication reminder using QR code to improve self-administration medication adherence in outpatients

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ABSTRACT: Frequent failure in taking medicine as prescribed possibly resulting in undesirable clinical and financial consequences. Hence, an android-based application called MedReminder is developed to keep track of outpatients' medication intake and provide an alert notification to remind them to take their medications timely. Quick Response (QR) code scanner is integrated with the application for an automatic medication prescription data entry. An open-source barcode library named ZXing library is used to implement a QR code scanner. The results indicate that MedReminder has successfully decoded the QR codes containing medication prescriptions, keep track of outpatients' medications intake status, and remind them to take their medications timely. MedReminder could assist outpatients in avoiding medication errors and promoting their medication safety.

Keywords: medication adherence; QR code; Android

1. INTRODUCTION

Medication adherence is the process by which patients consume their medications as prescribed [1]. Non-adherence could occur when a patient does not consume the medicine timely as prescribed. One of the common reasons is due to forgetfulness. Poor medication adherence leading to poor health consequences, and upsurges in health care costs [2]. Therefore, alerting outpatients about the time to take medication could inhibit medication non-adherence due to forgetfulness.

Quick Response (QR) code is a two-dimensional code used in a small picture produced by Japan's Denso Wave Corporation in 1994 to record thousands of numbers and characters [3]. The QR code can be used to simply convert the scanned code images into coded data and subsequently save it in a database. The QR code technology has been widely used in many mobile applications including e-shopping [4], smart-home application [5], and health management systems [6]–[8]. The use of QR code technology for self-administered medications has been proof could reduce medication error in both older and younger age groups [9].

MedReminder is proposed to overcome failure in taking medication timely as prescribed. Moreover, QR code technology is implemented to reduce medication errors. MedReminder will remind outpatients to take the

correct medication at the right time by setting the notification automatically according to their medication prescription. Besides, MedReminder generates outpatients' medications intake history to help them to keep track of their medications intake. This will help the outpatients with well-organized medications intake and fast illness recovery.

2. METHODOLOGY

The MedReminder application implemented a barcode technology called QR code. The QR code contains the medication prescription available on the medication label including medication name, dosage, frequency, indication, start date, and end date. The medication prescription to be encoded in QR code is written in JSON format. The QR code is then generated by using online tools. Subsequently, the QR code is saved in PNG format. The QR code will be scanned by the respective outpatient to automatically record the medication prescription data to the MedReminder database. The conversion of medication prescription data from a medication label to a QR code is illustrated in Figure 1.

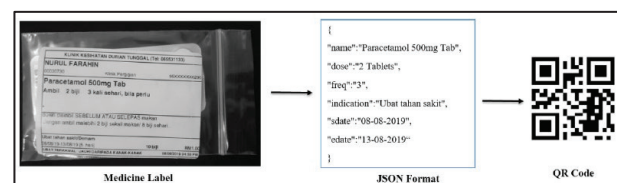


Figure 1 Data conversion

A QR code scanner is implemented in MedReminder to scan and decode the QR code of medication prescription by using an open-source barcode library named ZXing library. ZXing is a multi-format 1D/2D barcode image processing library implemented in Java. The MedReminder application requires the creation of Java objects from the IntentIntegrator and IntentResult class. Smartphone camera permission is requisite for QR code scanning to function. It is automatically incorporated as part of the ZXing library.

3. RESULTS AND DISCUSSION

Figure 2 shows the design of the medicine

prescription entry. Outpatients can enter their medication prescription data either by using manual data entry or scanning the QR code. The pop-up box appeared when outpatients tap on the list of medical records to get the medicine details.

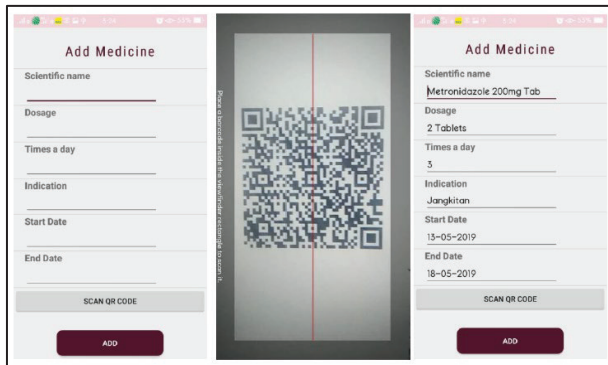


Figure 2 Medicine prescription entry

Figure 3 illustrates the design of medical history which can assist outpatients to keep track of their medications intake status. The pop-up box will appear when outpatients tap on the “missed” button to update their medication intake status. An alert notification received by an outpatient is presented in Figure 4. The notification will pop up with a default ringtone to remind the outpatient to take medication timely.

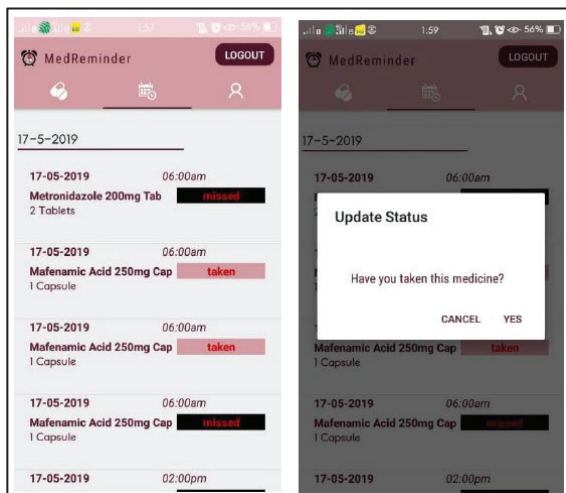


Figure 3 Medicine intake history

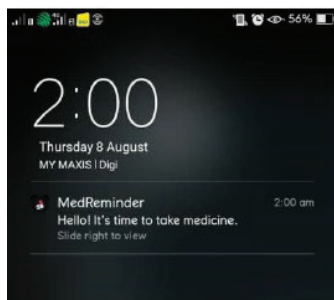


Figure 4 Alert notification

4. CONCLUSION

MedReminder can be useful by notifying patients

that they should take the correct medications at the right time as prescribed. Moreover, the QR code scanner implementation could assist outpatients in avoiding medication errors. MedReminder offers a plausible tool to promote medication adherence and medication safety in outpatients.

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