

# QR Code for Health Notification Mobile Application

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**Abstract**—This article reports an automated data entry for health notification mobile application. This project focuses on developing a mobile health (m-health) integrated with an automated data-entry technology, Quick Response (QR) code scanner, for easy data recording by scanning the generated QR code and eliminate the need of keying all details. The current healthcare management systems are still using the paper-based traditional method of data recording and distribution, including methods for giving out information on next appointment and prescription to the patient. The mobile application will be developed, conducted and tested on Android-based operating system and devices.

**Index Terms**—M-health, Mobile Application, QR Code, System Workflow

## I. INTRODUCTION

The widespread uses of smartphones at an unprecedented rate have revolutionized the way people access to information particularly in the health care sector. The use of mobile healthcare applications is a dynamic field and have received great attentions lately. This development provides mobile technology more attractive for mobile health (m-health) applications [1].

The m-health is defined as a wireless telemedicine involving the use of mobile telecommunications and multimedia technologies and their integration with mobile healthcare delivery systems [2]. M-health proposes the delivery of healthcare anytime and anywhere which surpasses geographical, temporal and organizational barriers [3-4].

In this project, the m-health application is an Android-based reminder application developed for the usage on smartphone. It addresses the common healthcare issue such as attending appointment and taking medication on a proper schedule as prescribed. The m-health application also has an option of entering data in a quick and easy manner by using the chosen automated data-entry technology, the Quick Response (QR) code.

QR code is a two dimensional code used to record thousands of characters and numbers in a small image created by Denso-Wave Corporation of Japan in 1994. Users utilize the QR code can simply use the software decode built-in into the systems to convert scanned code images into the coded information and save it to the database [5]. Most healthcare management applications [6-7] require the users to input

information themselves which is a tedious process. As an alternative, the user enters data into the m-health application, either using manual data-entry or simply scanning the QR code. User is required to identify the right data is entered into the provided edit text box. Once the data entered are confirmed through, the data will be save and store into the m-health application database. Lastly, the specific data fields are retrieved from the m-health application's database for viewing history list of recorded doctor appointment and prescription details, and for notification purpose.

The proposed m-health application is an android-based mobile application that records, process and retrieve health-related data, particularly information on the user's doctor appointment and medication prescription. The automated data-entry technology implemented into the proposed m-health application is QR code technology, where this technology will eliminate the issue on tedious and time consuming manual data-entry.

The proposed m-health application will also provide a categorized history inventory for quick viewing on recorded appointment and prescription details. As for the notification feature, it is set to trigger automatically with every appointment and prescription inserted into the proposed m-health application. This kind of m-health application may become essential during emergency, where in case of trouble, a stranger may identify the problems with the user immediately by viewing their history records such as previous medications, history on allergy to any medications and other significant medical or surgical history. Besides that, it facilitates medical officers to have a quick look and optimize their valuable times used to identify the problem faced by their patients.

The organization of this research is sequenced as follow: Firstly, an overall architecture of an m-health system is proposed. Secondly, a system workflow is generated. Thirdly, an experiment is conducted and tested to display the results with their analysis. Finally, a conclusion is drawn.

## II. PROPOSED RESEARCH

The proposed approached of this application is to develop a notifying mobile application on health related matter particularly on any upcoming doctor appointment and medication intake time, where the application is integrated with the chosen automated data-entry technology. The notification feature of the m-health application will be developed using the available Android's basic programming methods which are the Broadcast and Broadcast Receiver, and AlarmManager.

The automated data-entry technology chosen is the QR code technology. It have been said that both technology used for notification and data-entry are the most common technology used due to its simplicity and direct

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implementation. However, integrating these features into the m-health application may not be as easy as it sounds.

As presented in Figure 1, m-health application works and runs on three phases. The first phase starts when the user enters data into the m-health application, either using manual data-entry or simply scanning the QR code, given new doctor appointment and/or new prescription. In the second phase, user is required to identify the right data is entered into the provided edit text box. Once the data entered are confirmed through, the data will be save and store into the m-health application database. Finally the specific data fields are pulled from the m-health application's database for viewing history list of recorded doctor appointment and prescription details, and for notification purpose.

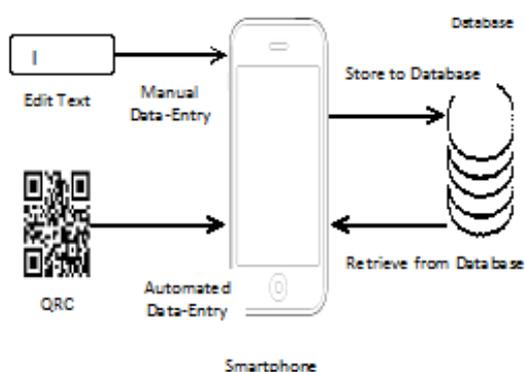


Fig. 1 Overall Architecture Of An M-Health

### III. EXPERIMENT SET-UP AND ANALYSIS

M-health mobile application is an application developed for the usage on portable communication devices such as Smartphone, tablets and PDAs, where it utilizes the devices' features such as the operating system, Internet connectivity, data storage, a camera and media player to achieve their health-related objectives. Generally, m-health application main task is to gather and manage data on health related matter for a better and improved efficiency and effectiveness on health data and care management

Essentially, the developments of an m-health application depend on three components. Firstly, the best programming language suited for the m-health application. Secondly, the best device suited for the m-health application's deployment. Lastly, the selection of a data base management systems (DBMS) which includes setting up and configuring the database which has a profound benefit and ease of use [8-9]. Some m-health application also requires external sources or plugins that are usually for adding certain functionality feature to achieve proper application development.

The first characteristic of the m-health application is the programming language. The selection on programming language use depends on the platform needed by the application. Some of the popular platforms for m-health application are Apple OS, BlackBerry OS, Google Android OS, HP web OS and Windows Phone, where the most programming languages used to develop mobile application are Android programming language, java programming language and iOS SDK package.

There are many more programming languages and operating platforms that can be used to develop the application. However, these top programming languages and platforms are amongst the best choice because the demand for the application defined by the market or target user. Therefore, the target users for this project are Android platform based mobile users.

The second characteristic, selection of communication device also depend on the programming language and platform choice, where the m-health application need to be deployed on certain device's environment where the application will be install, run and utilize. Smartphone has fast growing trends among all range of age in society due to its ease of use, lightweight of nature, long battery life and connectivity. The best selection thus far on communication device selection is Smartphone, specifically the Android-based smart phone. Android Smartphone are at its best due to its affordability and user-friendly criteria.

The last characteristic is the database used for the m-health application. The most common database selections are lightweight database, the application main database, system server database and cloud computing. There is no best selection for database as database are determine by the purpose of building the mobile application as well as by the connectivity to be use. As the proposed m-health application only requires a small amount of storage to store the small sized information, therefore lightweight database is selected, which is the SQLite database.

In addition, mobile application has the flexibility to be program with external libraries or plugins. These libraries and plugins are usually needed for the functionality they have to offer. In this project, an open-source library is required for the feature of automated data-entry.

There are many open-source libraries available for barcode scanner and reader on the Internet. Some of the few are ZBar, ZXing and Android barcode library. Any of these libraries will be efficient enough to integrate the automated data-entry technology into the m-health application.

#### A. System Workflow

The m-health application needs to be an Android mobile application for smartphone with basic functionality of recording data for notifying and viewing purpose. The m-health application is also require to be incorporated with a QR code scanner.

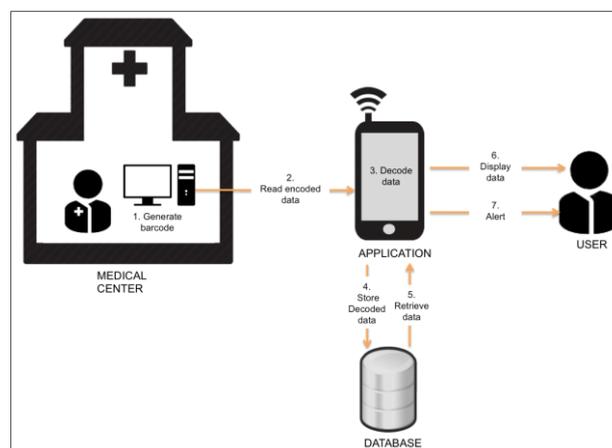


Fig. 2 System Workflow

For this project, the method and tools used to develop the Android application is by programming from scratch with the help of code-writing software named 'Eclipse'. Android and Java will be the main programming language used, where the application will be deployed and run on Android platform devices. The Eclipse software is downloaded from Android developer website (<http://developer.android.com/index.html>), where the Eclipse is renamed 'adt' and have been pre-installed with the necessary Android SDK and ADT bundle. While the codes used in the application are based from the appropriate Android tutorial and example found in the Internet.

As for the virtual machines provided in Android SDK will be used to run and test the Android application build. Virtual machine will be created and configured by providing AVD name, Target name, platform, API level and CPU/ABI. The configuration of the Virtual Machine can be done through the Android Virtual Machine Manager found in the 'adt' software. Meanwhile, to test and run the Android application on real devices, Active Virtual Devices (AVDs) will be used by creating the proper connection with the actual device, which is also configured through Android Virtual Machine Manager under the device definition tab.

The m-health application will need a database to store the appointment and medicine prescription data. However, the requirement for the database is only a little. The database simply must be able perform the basic function of CRUD (Create, Retrieve, Update and Delete) operation and provide adequate amount of storage space. This is achieved with the utilization of SQ Lite. The SQ Lite database will be built programmatically on the Android coding list by creating two classes, the DBHelper.java and GetSet.java class.

The m-health application will be integrated with Barcode technology, particularly QR code scanner. The QR code scanner will be incorporated with the use of ZXing library, an open-source barcode library. The ZXing library can be downloaded from the link GitHub website. (<https://github.com/zxing/zxing>). The barcode scanner will be implemented with ZXing library as a standalone application. In order to accomplish this, the downloaded ZXing library will be imported as a separate Android application project and is 'checked' as 'is Library'. The core.jar file in the downloaded ZXing library will also be imported into the mHealth application as external library. If the above technique does not work, we will use the other resort method of using Scanning via Intent. With the other option, the mHealth application only requires the creation of two Java classes: the IntentIntegrator and IntentResult. Both of this Java class coding can be copied with the copyright commentary from the download ZXing library. Conversely, the Scanning via Intent method requires the actual device to download barcode scanner application made from the ZXing team.

The aim of the m-health notification system is to alert the user by generating a simple notification message on the Notification Status Bar. The notification need to be set with content tile, large icon, content text, small icon and time that the notification is issued. The notification is trigger by the inherited method found in the Android developer APIs, which is AlarmManager. AlarmManager methods allow scheduling

of application operation to be run at some point in the future by defining the date and/or time. The AlarmManager will also be deposited with wake lock configuration that allows devices to execute the registered notification even when the device is asleep.

Lastly, the m-health application requires a proper viewing system. The simplest method for developing a simple view system is by using the Android's List Layout incorporated with ListAdapter and ArrayAdapter. The ListLayout will be created using a custom ListLayout with the use of ListView component.

### B. Interface Design and System Testing

The m-health application is tested on a Samsung Ace GT5830 with Android platform version 2.3.3 via an Active Virtual Devices (AVDs). The application design focuses on the elements of the user experience such as user requirements, functional specification and requirements of content [10].

As the m-health application runs from the code-writing tools, 'adt' software, the first main page also known as the menu page of the m-health application will appear as shown in the Figure 4. The menu page have four buttons: Scan Appointment button, Scan Prescription button, Appointment button and Medication button.

The Scan Appointment button will bring the user to the page for scanning appointment QR code for record-keeping, similar with Scan Prescription button for scanning prescription details. As for the Appointment and Medication button, it will direct the user to Appointment and Prescription list page respectively, where the data recorded are listed in the listview component added on the list page.

The process of adding new data using the integrated ZXing barcode scanner, the user will need to click on either the Appointment or Prescription Scan button depending on which data they wish to record. Once clicked, user will be directed to a scan page, which consists of a scan button and two TextView fields. (As shown in Figure 4 and Figure 5)

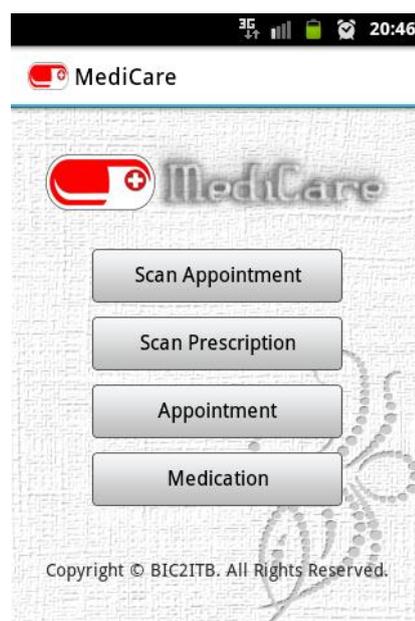


Fig. 3 Main Menu Page

The scan button will initiates the camera view provided

with a text box. The text box on the camera view is where the QR code should be placed and read. Once QR code has been read, the data from the QR code will be transferred from the camera view to the previous scan page and displayed on the provided TextView fields.

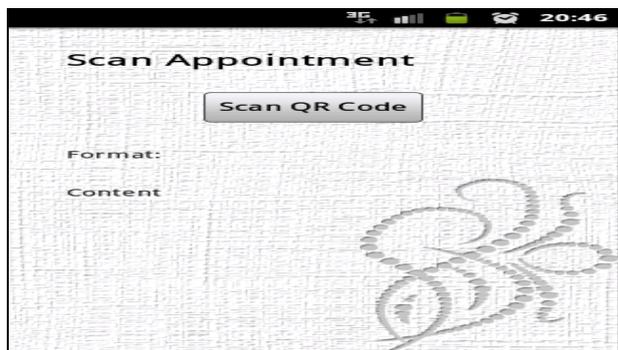


Fig. 4 Scan Appointment

When the user wishes to scan a QR code, they just place and aim the QR code into the provided box on the camera view. The camera will automatically detect the QR code and decode the data directly. For testing purposes, the QR code is scanned with a sample QR code containing a URL, due to the unavailability of a free QR code generator for appointment and prescription details.



Fig. 5 Scan Prescription

The decoded and extracted data from the QR code is shown on the bottom of the smartphone screen. (Figure 6) This data will be transferred back to the scanning page and displayed on the textview provided.



Fig. 6: Format Code

As the Appointment and Prescription scan button is clicked, the user will see a new page for scanning a QR code as shown in Figure 7 and Figure 8. When the user clicks on the scan button, the display will change to camera view. The

camera view is integrated with QR code scanning mechanism.

The process of adding new data starts when the user clicks on the Appointment or Medication button settled in the MediCare main menu page, which will direct the user to the List page of appointment or prescription recorded data. On the List page, another button is presented where it leads the user to add new data page.



Fig. 7 Appointment

On the add new data page, edit text fields are provided according to the information required for the specified data, where at the bottom of the page, there are two buttons, the Save button and the Cancel button. After filling in the edit text box with proper data, the Save button will read each edit text field and save the data into the m-Health application's database. While the Cancel button simply redirects the user to the previous list page.

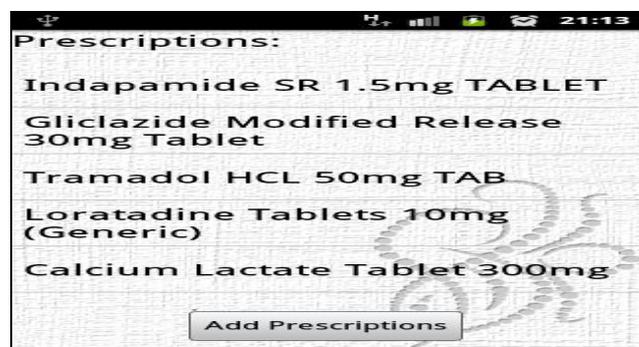


Fig. 8 Prescription

#### IV. CONCLUSION

The core of the m-health application is to provide a reliable and functional reminder for any upcoming doctor appointment and medication intake time. With the frequent use of the m-health application, the society will be encouraged to utilize smart phones to their full competence. Society will be able to gain benefit from utilizing the m-health application as the feature of displaying previous appointment and medication may indicate the user's health status and determine their lifestyle. The m-health application allows the user to be more aware of their health status and is able to change for a better healthier lifestyle when necessary.

On the medical side, the mobile application may increase appointment adherence despite the users' busy schedule. With the notification feature, the user will be more aware of their medication and lead to better and accurate medication

consumption according to prescribed, therefore preventing overdose or forgotten medication. On the whole, the mobile application encourages better management in appointment and medication intake time. At the same time, allows user to take control of their health.

Overall, the m-health application has proven to have the potential in serving as a personal health reminding mobile application for doctor appointment and medication intake time. However there are many factors that require improvising based on the experiment conducted, especially on the scanning and notification system.

In summary, this research focuses on the development of an m-health application integrated with an automated data-entry technology to:

- (1) Encourage people to use m-health application
- (2) Notification for health-related matter.
- (3) Increase patient adherences for doctor appointment.
- (4) Encourage patient to follow or obey medication Instruction
- (5) Allow patient to obtain accurate information needed.
- (6) Avoid any unnecessary health risk such as overdose and late diagnosis among others.

The solution for m-health applications are becoming increasingly popular because they can be used by a great number of people and targeted for different health issues or groups of patients [11-13].

Future developments in wireless communications integrated with developments in pervasive and wearable technologies will have a radical impact on future healthcare delivery systems [14].

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