Medi-QR, Multiple Medication Reminder using QR Code

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Abstract— This project is to design a QR code system to integrate into the medical sector to aid people who suffer from illnesses. An efficient way to solve this problem is to create a QR code which contains the patient's medicinal information. A mobile application or Google lens can be used to scan the code and obtain the patient's medication. The system alerts the user to consume his/her medicines on time. In case of the patient being unable to do so, his/her well-wishers can take up the role of doing so. After scanning the code, it leads to the Google calendar where reminders are pre-set. The design of this system allows the doctor, user and his/her immediate family to access the medication taken by the patient. The doctor records his instructions on the website and converts the data to a QR code. The QR code is printed on the prescription after the consultation is done. The entire process is done to help patients remember and not misinterpret the instructions given by the doctor.

1. INTRODUCTION

In this project an Android-based reminder application has been developed for the usage of it on a smartphone. It addresses the common healthcare issue i.e. taking medication on a proper schedule as prescribed by the doctor. It 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. Quick Response codes, popularly known as QR codes have made our lives way simpler, easier and efficient. They are basically a type of matrix barcode which convey details about the product. Nowadays, every other smartphone is equipped with a QR code scanner to scan these codes and gain their information. The idea here is to integrate QR codes with the healthcare sector at the grass root level and ensure that it is utilized to its maximum across India. People usually end up forgetting the doctor's instructions and struggle to recollect this information. With this, patients will be able to go through the instructions again without any doubt. In case the prescription is torn or damaged, they can scan the QR code to regain the information. With the QR code scanned, reminders will be set using the in-built calendar app directing you to consume your medicine at a specified time and date.

2. LITERATURE SURVEY

Many medication systems have been developed based upon different platforms and concepts. Use of healthcare related apps is growing but there are several issues related to their functionality. The involvement of information and communication technology (ICT) in health solutions has shown to raise satisfaction both for health care providers and patients. Several methods of using mobile apps in healthcare have been introduced and studied.

Anglada-Martinez et al.[1] conducted a systematic review of articles relating to mobile health to evaluate the use of mobile health effectiveness in medicine adherence. In their study, they identified 20 papers from 1504 articles to fulfil a specific criterion for mobile health. The articles were categorized depending on the target population. In their reviews, it shows that adherence improved in four of the studies on HIV-infected patients, in eight of the studies on patients with other chronic diseases, and in 1 study performed in healthy individuals. All of the studies reported sending SMS as medication reminders, healthy lifestyle reminders, or both. Today, there are far better ways to reach patients other than SMS. Smart devices equipped with internet connectivity, LCD screens, sensors

and actuators allow a better way to interact with patients. By 2019, The number of mobile phone users is expected to exceed the 5 billion mark. Similarly, it is also expected that smart phone users grow from about 1.5 billion users in 2014 to about close to 2.5 billion by 2019 .[2]

Heldenbrand et al.[4] studied medication adherence app features, functionality, and health literacy level. The authors conducted a survey in June 2014, to identify available adherence apps. They identified 461 adherence apps, of which 367 unique apps were evaluated after removing Lite/Trial versions. They evaluated the applications based on attributes that are divided into 5 domains (Adherence Attributes, Medication Management, Connectivity, General Features, Health Literacy). The results of their study are used to help patients and health providers to find medication adherence mobile applications through their website develop based on the outcome of their study. In their website www.medappfinder.com,patients are free to select the best medication adherence mobile application that fit their needs based on the following criteria (free, Has Non-English Option, Tracks Missed/Taken Doses, Can Snooze Reminders, Has Refill Alerts, Identifies Potential Adverse Interactions, Orders Refills, Provides Reminders without Cellular Service (or wi-fi) and Easy to Read (common words)).

Prasad B has discussed the approach of Medicine reminder pro. It is a free application which supports up to 15 reminders. User can select them in either repeating or non-repeating alarm patterns. Any hourly time interval between alarms can be selected, starting from the minimum of 1 hour. At the scheduled time, application will produce a notification with an alarm, vibration or LED indication.

Bruno M. Silva, Ivo M. Lopes, Mickael B. Marques, Joel J.P.C. Rodrigues, Mario L. Proenca Jr., have proposed a mobile health application called SapoMed primarily for medication administration management. The advantage of this proposed system is that it is easy to use, allows user to register drugs manually, and saves past intake medication and records. But in this system the complete list of medication identification is not present.

Several medication adherence mobile application have been evaluated. One of which is “MediSafe Pill reminder” [8]. “MediSafe Pill reminder” is an Apple smart phone application, which generates an alarm when it is time to take medication. This application shows that medication intake occurred as a result of the monitored person providing the application with an input, which indicates they took the medication. If the person fails to provide input, the application notifies a caregiver so that the caregiver can intervene to remind the person about his medication adherence. Other applications such as MyMeds[11] provides numerous functionality, however does not have food and drug interaction information. In our literature review, most of the application provides various functionality and suits a lot of patient needs, however, none of them have the ability to verify intake. Conceptually, it is possible to deduce activity by analyzing the patient movements.

Serdaroglu, Uslu and Baydere[12] discuss the possibility of using an IoT device on the wrist such as a wrist watch on the patient to detect and track motion. It is argued that certain motions can be classified and the activities related to medicine adherence involves identifying the activities in an order. This series of activities can be noted as adhering to medication intake. Nonetheless, the authors did not actually develop the application, but merely discuss the network complexity involve in implementing such requirements. Another way to verify consumption of medication is by forcing the user to provide a proof of work that he has touched the medication. Which we cannot really monitor a patient to actually swallow the medicine, we can however force the patient to at least seek out his medication. It seems like a real waste of effort to have the medicine in hand but not taking the medication.

In our solution we are making a system such that it is very easy to remind the patient to take medicines on time using QR codes. Primarily we take the input about the patient’s prescription such as which medicines are to be taken on what time and how long the patient should undergo medication. These details have to be entered by the doctor or attendant hospital faculty. The doctors are given a well defined web interface which contains the ability to generate a QR code which will print it along with the prescription. The patient has to scan the QR code through google lens and then add to the google calendar which will then automatically notify them about the alarms as prescribed by the doctor.

3. DESIGN

Medi-QR is implemented with the help of Java programming language. There are several stages for this project. They are Login, Information Entering, Generating Prescription and QR code and adding events in their respected mobile.

Login page was designed using Java swing class. Java swing class has methods like text field, password field and several buttons. Using these modules login page was created which contains entering username field, password field and other buttons to perform login, cancel and exit.

The main stage of this project is entering information about medications that have to be taken by the patient. To collect sorted, organized data various text fields and buttons were used. Doctors name and patients details are entered through text filed. To add the date module named as date picker is designed. To select the tablet information

drop down menu is used. This is designed such a way that when a tablet is selected other fields are filled automatically. There is also a
option to add new tablet also. Date and time picker is used to select date of starting the event and ending it. To choose when should the tablet have to be taken another drop down menu is used. All the information are updated in a table using update button.

QR code is generated using module Barcode generator and this QR code will contain the download link of the file. The QR code generated was embedded into a PDF file with all other information required in prescription. To design a PDF pdf writer module is used.

To scan the QR code there are various applications available in smart phones and any application can be used. Google lens is used here because it is inbuilt in every android phone and the QR code is designed to get the required file that has to be added to the calendar.

4. BLOCK DIAGRAM AND IMPLEMENTATION

The following figure shows the flowchart of this system.

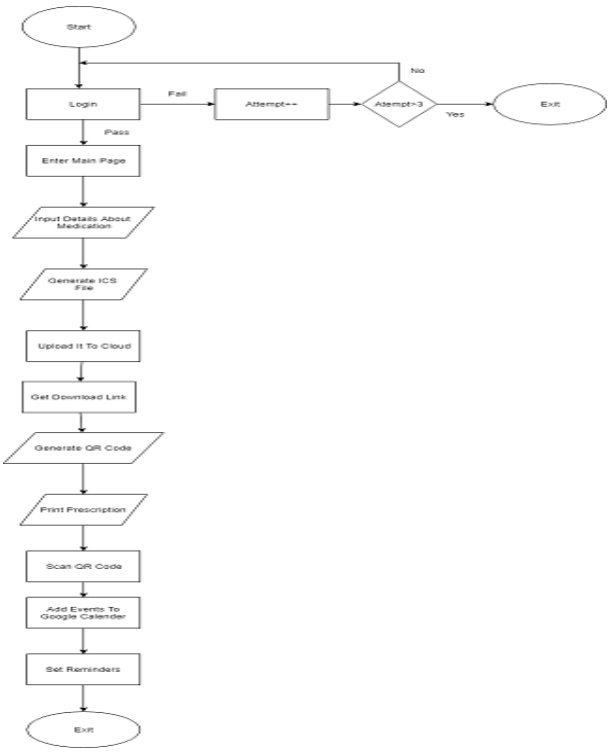

Figure 1 : Flow chart of proposed system

The whole System contains several steps and each step has it's own functionality as follows:

Initially, the admin needs to login to the page by entering the username and password.If the login attempt fails by more than three times, then the system will exit the page, thereby ensuring the security.

Once the login is successful, a form like page appears which has been built using Java GUI and Java swing.This page details the patients information such as name, gender, contact number and DOB. The tablet name, its description, the dosage required and the dates are also to be specified.After clicking on update, the information is tabulated which can then be used to generate an ICS file .
The ICS file contains information about the patient and his/her medicines. This ICS file is then uploaded to cloud. The download link is generated that is embedded in the QR code.A pdf is generated which contains patient details and QR code. After scanning the QR code, the medicines along with their information is displayed.

An option is provided through which this can be added to google calender, thereby setting reminders at respective times to ensure consumption of medicines on time.

The above figure represents the flow chart of proposed system. Since smart phones are taking over the world this method is very useful and efficient.

When patient visits doctor, doctor will examine the patient and suggests medications. This information has to be entered in the interface by the prescriptionist or helper.

By the information entered by the interface will create an event with the information about medicine name, date of birth of patient and the timings at which medications has to be taken.

This event is encoded and converted into a QR code by the interface. This QR code is printed with the prescription given by the doctor.

QR code is scanned by the patient or any acquaintances of the patient who will remind the patient to take medication. With the help of google lens QR code is scanned.

After scanning the QR code the interface will ask the permission of the user to set the reminder in his mobile phone.
Granting the permission will set the reminder and time to time reminder will alarm the patient or patient's acquaintance to take medications.

5. RESULTS

The screenshots of the project are shown below. This shows the step by step detailing of how the execution happens.

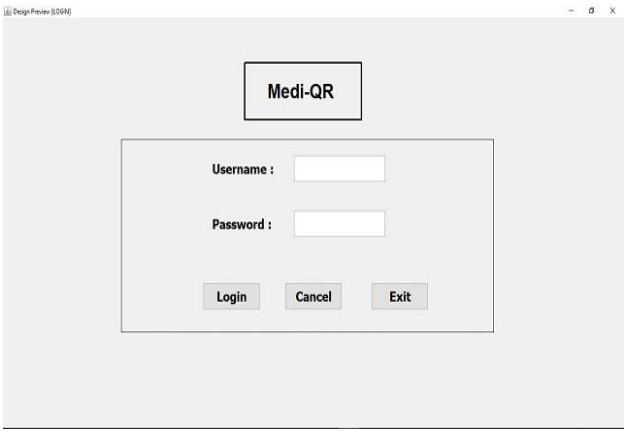

Figure 6.1: Admin login page

The admin login page which provides access to the data entry page.

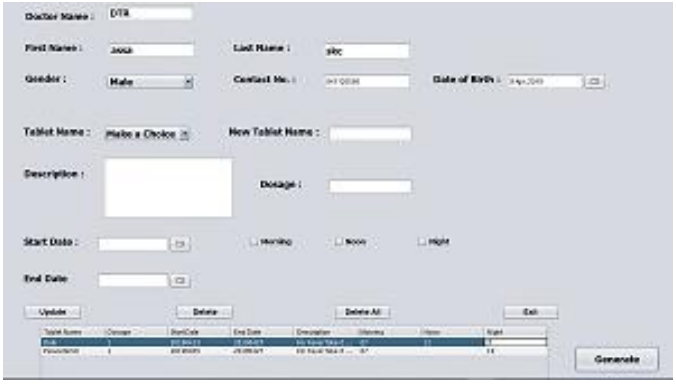

Figure 6.2: Data entry page

The data entry page where the medicinal details are entered.

Figure 6.3: Prescription generated

The prescription generated shows the patient details and the QR code.

Figure 6.4: Generated ICS file

The generated ICS file displays the medicines that need to be consumed and at what time.

6. CONCLUSION

In this project we implemented an idea which involved reminding the patient to consume their medicines on time. This was done primarily with the help of Java swing and GUI. A login page was created which allowed the admin to access it and prescribe medicines which ultimately resulted in a QR code being generated and subsequently being transformed into reminders on google calendar. The primary objective of the project was to aid people to have their medication on time. Missing out on medication in the long run, costs the common man a lot which leads to the very purpose being defeated. The aim of this project was fulfilled and was in line with our expectations.

The future of this project holds a lot of potential. The patient data can be centralized i.e. stored in a database monitored by the doctor. The security aspects can be made better.

This can also be used in various other industries by changing the data but retaining the core concept.

REFERENCES

[1]. H. Anglada-Martinez, G. Riu-Viladoms, M. Martin-Conde, M. Rovirallamola, J. M. Sotoca-Momblona, and C. Codina-Jane, “Does mhealth increase adherence to medication? results of a systematic review,”International Journal of Clinical Practice, vol. 69, no. 1, pp. 9–32, 2015.

[2]. A. Choi, A. W. Lovett, J. Kang, K. Lee, and L. Choi, “Mobile applications to improve medication adherence: Existing apps, quality of life and future directions,” Advances in Pharmacology and Pharmacy app, vol. 3, no. 3, p. 6474, 2015.

[3]. V. Arya, R. Alam, and M. Zheng, “Medication adherence: Theres an app for that,” Pharmacy Today, vol. 19, no. 6, p. 34, 2013.

[4]. S. Heldenbrand, B. C. Martin, P. O. Gubbins, K. Hadden, C. Renna, R. Shilling, and L. Dayer, “Assessment of medication adherence app features, functionality, and health literacy level and the creation of a searchable

web-based adherence app resource for health care professionals and patients," Journal of the American Pharmacists Association,vol. 56, no. 3, p. 293302, 2016.

[5]. R. Mohd Nor, A. M. M. Ridzuan, and M. J. M. Razi, "The design and implementation of a qr-code enabled mobile online judging application," in Information and Communication Technology for The Muslim World (ICT4M), 2014 The 5th International Conference on. IEEE, 2014, pp. 1–5.

[6]. T. J. Soon, "Qr code," Synthesis Journal, vol. 2008, pp. 59–78, 2008.

[7]. K. Seino, S. Kuwabara, S. Mikami, Y. Takahashi, M. Yoshikawa, H. Narumi, K. Koganezaki, T. Wakabayashi, and A. Nagano, "Development of the traceability system which secures the safety of fishery products using the qr code and a digital signature," in OCEANS '04. MTTS/IEEE TECHNO-OCEAN '04, vol. 1 .

[8]. Zao J.K., Mei-Ying Wang, Peihsuan Tsai, Liu J.W.S., "Smart Phone Based Medicine In-take Scheduler, Reminder and Monitor", IEEE e-Health Networking Applications and Services (Healthcom), 2010 "Medcoach medication reminder by greatcallinc." [Online].Available: https://itunes.apple.com/us/app/medcoach-medication-reminder/id443065594?mt=8

[9]. Deepti Ameta, Kalpana Mudaliar and Palak Patel, (2015)"Medicine Reminder and Healthcare – An Android Application", International Journal of Managing Public Sector Information and Communication Technologies, Vol. 6, No. 2

[10]. Slagle, J.M., Gordon, J.S., Harris, C.E., Davison, C.L., Culpepper, D.K., Scott P. and Johnson, K.B., (2011) "MyMediHealth – Designing a next generation system for child-centered medication management", Journal of Biomedical Informatics, Vol. 43,No. 5, pp. 27-31.

[11]. Mei-Ying Wang, John K. Zao, P.H. Tsai, J.W.S. Liu, "Wedjat: AMobile Phone Based Medicine In-take Reminder and Monitor",Ninth IEEE

[12]. R. Mohd Nor, A. M. M. Ridzuan, and M. J. M. Razi, "The design and implementation of a qr-code enabled mobile online judging application," in Information and Communication Technology for The Muslim World (ICT4M), 2014 The 5th International Conference on. IEEE, 2014, pp. 1–5.

[13]. Y. Zhang and N. Ansari, "Wireless telemedicine services over integrated IEEE 802.11/WLAN and IEEE 802.16/WiMAX networks",

[14]. Chihwen Cheng, Clark Brown, Tamara New, Todd H. Stokes,Carlton Dampier, May D. Wang, "Sickle REMOTE: A Two-WayText Messaging System for Pediatric Sickle Cell Disease Patients",Proceedings of the IEEE-EMBS International Conference onBiomedical and Health Informatics (BHI 2012) Hong Kong andShenzhen, China, 2-7 Jan 2012. IEEE Wireless Communications, pp. 30-36, 2010 International Conference on Bioinformatics andBioengineering, 2009.

[15]. K. Serdaroglu, G. Uslu, and S. Baydere, "Medication intake adherence with real time activity recognition on iot," in Wireless and Mobile Computing, Networking and Communications (WiMob), 2015 IEEE 11th International Conference on. IEEE, 2015, pp. 230–237