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# Android Portable Personal Health Record Using CCR Standard

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**Abstract:** The increase numbers of smartphones worldwide led to the prevalance of many mobile health applications (M-Health). Many health applications are available now. The problem with most of these applications is that it doesn't use any proper standards for exchanging medical information across different medias. In this paper we propose a complete dual PortablePersonal health record (PPHR) which uses a standard format that is continuity of care records (CCR) to tranmist medical information.Using CCR standards. This will solve interpoerability issue if we decide to send data to any clinic's or hospital's database. In addition the system will utilise the usage of mobile Networks and Wi-Fi to send those data, which can improve the availability of the service in rural areas that may lack Internet coverage.

**Key words:** Mobile health, Personal Health Records, Continuity of Care Record, healthcare

## INTRODUCTION

Telehealth is considered to be the next step in providing a complete healthcare for normal users and patients. Telehealth uses communication technlogies to adminstrate and exchange medical information in long distance[1]. This industry was boosted due to the lack of medical facilties in places worldwide plus the increase number of smartphones users worldwide. According to Cisco mobile data traffic worldwide has doubled for the fourth year in a row (West, 2012). The mobile health applications can be very useful in monitoring chronic diseases for eldery, remainding people to take medications and generally maintain a healthier lifestyle. (West, 2012)

Despite the wide spread of mobile health applications or portable personal health records one of the major problems that faces such systems is the interporability. Many IT-vendors were reluctant to address interoperability issue in their systems despite the importance of it (Trotter & Ublman, 2011). Interoperability means that any PPHR's data can be read and exchanged with any medical facility that support proper standards, this allows easier mobility of data and more accuracy. Another issue with most systems is that they exculsively use mobile networks or Wi-Fi but not both.

***Literature Review:***

The concept of PHR is not new. The earliest reference to PHR can be traced to an article by Okawa in 1973.(Olla & Tan, 2009). There is no uniform definition of " Personal Health Record" in industry or government. (U.S. Department of Health and Human Services, 2006). Three decades ago PHR was limited to paper based form which can be in the form of small card or booklet which inculde immunizations recorded on it. (Olla & Tan, 2009). The advanced technologies pushed the idea of giving up on papers form PHR and implmenting electronic form of it. The most two used technologies were web based and mobile applications. While the web based PHR started to appear before mobile PHR, the later followed soon after. Having said that, the trend now is to integrate the web PHR with the mobile PHR and synchronize both parts.

Based on our literature review health applications can be divided into three main categories:

1. Web Personal Health Record
2. Mobile Health Applications
3. Mobile Personal Health Record

Most of the current PHR are web based (Olla & Tan, 2009) They are only ubiquitous on the World Wide Web. Most of the online PHR starts with registration process then the user can insert information about his/her health. Example of these systems are: Indivo X and Microsoft Health Vault.

Indivo is considered to be the first Electronic Personal Health Record. Indivo is "a distributed, web-based, personally controlled electronic medical record system that is ubiquitously accessible to the nomadic user, built to public standards, and available under an open-source license." ( Indivo X, 2009). The Indivo's beginning can be traced back to a previous project named "Guardian Angel". This project was a result of collaboration between Harvard and MIT. The vision was to have a web-based system which monitor and manage medical information and decisions. This project evolved from Indivo (PING) to the future vision of Indivo x. The Indivo x implements the concept of PCHR (Personally Controlled Health Record) where the patient can manage and keep a secure digital version of his/her medical information. (Indivo, 2010)

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HealthVault enables the user to take full control of their health information and decide to share it with whom. HealthVault is an online application which offers some useful features such as: collecting medical information from all different kind of sources. The user can key in his information, upload documents and medical images and use a service to collect all medical records and change it to digital form to be stored in HealthVault. Another feature in HealthVault is the emergency which basically stores critical health information about the patient which can be accessed in the case of emergency. (Microsoft HealthVault, 2012)

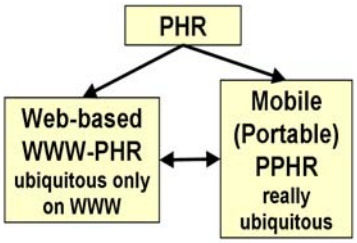
These applications in general keep little if any medical records about the users. The main functionalities of these systems are to send to diagnosis of a medical condition to a server in a medical facility where the condition will be assessed by medical experts. Examples of these applications are: In Case of Emergency (ICE) and SANA.

a combination of CapMed, icePHR and microsoft HealthVault. The purpose of icePHR is to provide the necessary medical information in case of emergency. The user can choose which data to be accessible in case of emergency by using a web application. In order to use this application a user must have icePHR subscription, also the the mobile device must meet the requirement to install and run the application successfully. Smartphones, Blackberries and standard mobile phones using Java Midlet are compatible with icePHR. If the mobile doesn't meet the requirement to run icePHR, medical records can be accessed by WAP to view medical records, however in this case it is not possible to modify stored data. (Olla & Tan, 2009)

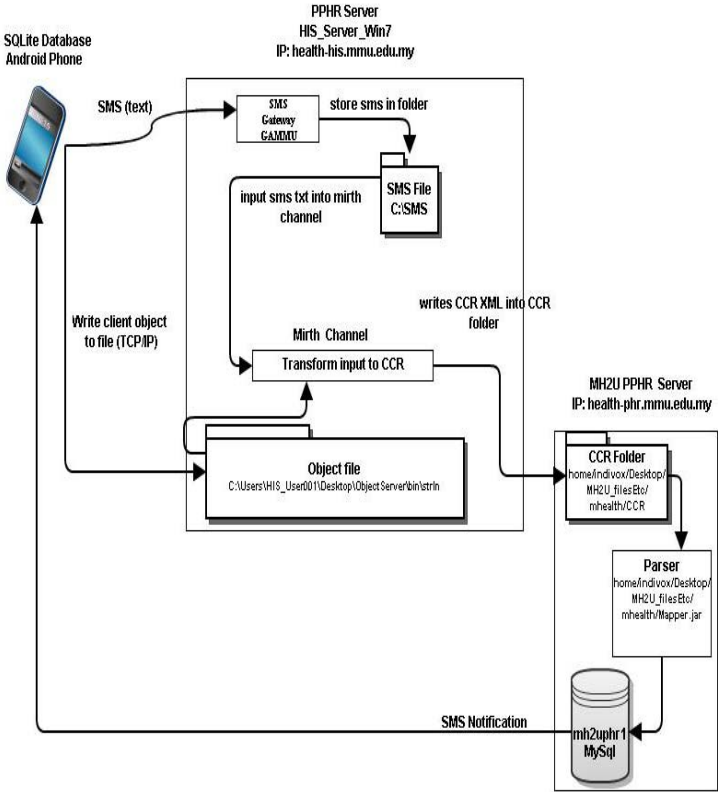
SANA is a volunteer organization that is hosted by MIT, Harvard and other universities in Boston area. It offers an Android based open source remote application. This telemedicine application is designed to work in poor settings.(SANA, 2012). SANA uploads the information to OpenMRS where the doctor can review the data and send the diagnosis to the SANA application where the health worker can receive it. SANA can support audio, images, location based data and in the future, videos. The open source nature of this application encourages further development and enhancement that can be deployed by users to customize the application to their preferences. It is important to notice that the main users of SANA Mobile are the healthcare workers. (SANA, 2012)SANA has a specific workflow; a normal workflow starts by a patient visit where the healthcare worker will collect the patient's information through the procedures. These information are uploaded to OpenMRS and a medical expert will be notified. The medical stuff will review the patient's condition and prescribes a treatment course accordingly. (SANA,2012).

***Methodology:***

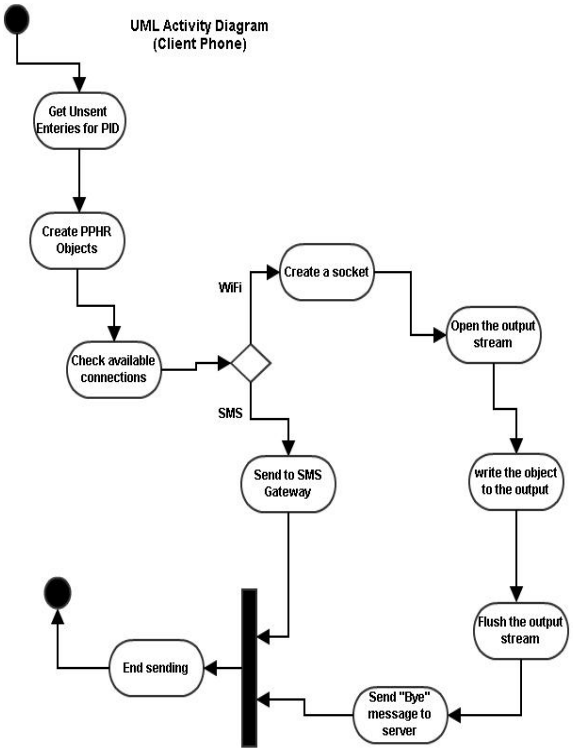
The proposed PPHR written in Android will solve the interoperability issue by using CCR format, while having a dual transmission method will increase the availability to use the personal health record. Figure belows shows the general overview of the system which consists of client (Android Phone) and a server:



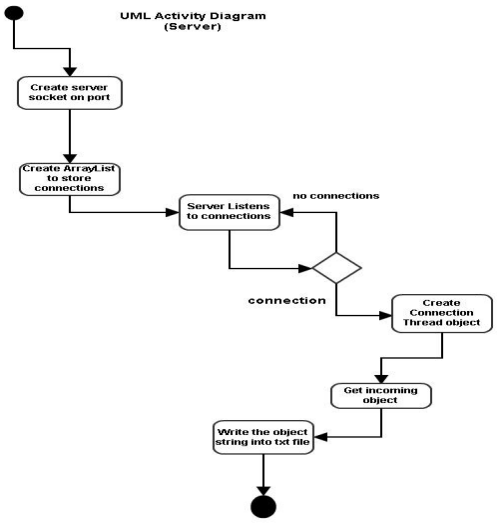

The user will create a profile that is his/her personal Health Record. Then the user will be able to send a symptotm or a problem he/she is facing. The General framework for the suggested system can be seen in the figure Below:



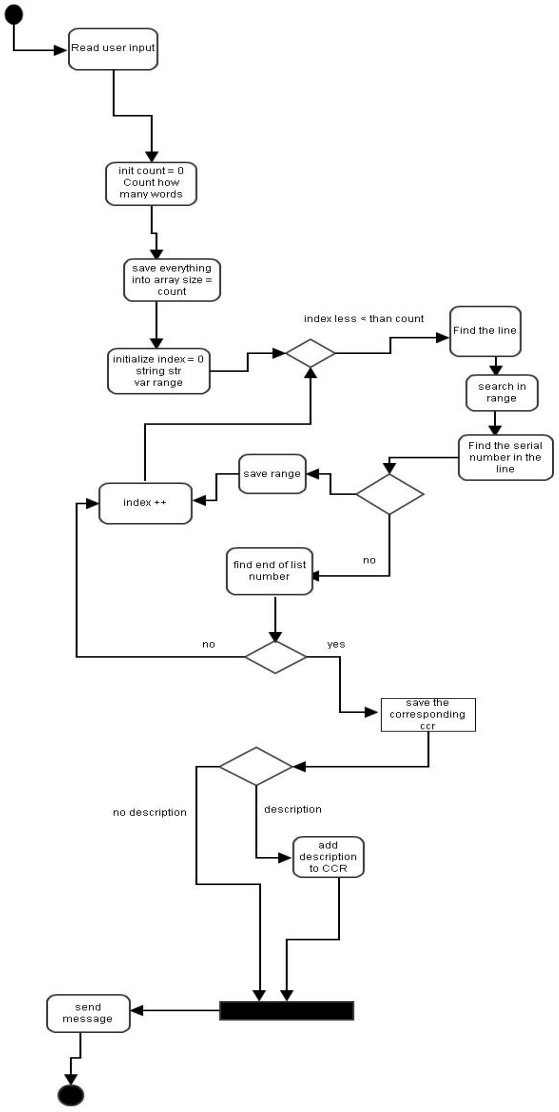

To solve the availability issue 2 ways of communications are used: mobile network and Wi-Fi. The application will choose Wi-Fi by default if both are available:




Sending through Moble network (e.g SMS) will be received and saved through an open source SMSgateway such as Gammu or frontline. If data is sent through Wi-Fi, then a java object module will handle the transmission of data:



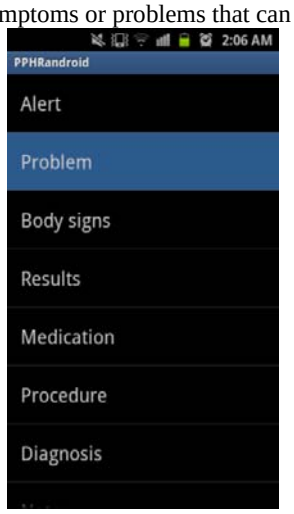

For Interoperability CCR will be used as mentioned earlier the translator module will use a mapper text file that will consist of the translation rules:

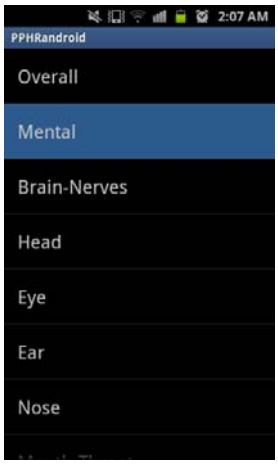



***Results:***

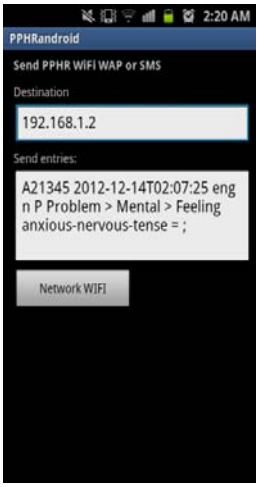
The Android PPHR will allow the user to create an account and start saving his/her medical information. In addition the user can send their information to the server:


The user can browse through a list of symptoms or problems that can be send to the server:






Depending on availability the PPHRandroid will choose the best available connection. In this case Wi-Fi is used since it is available:




If the area doesn't have internet coverage then Mobile networks will be used and SMS will be sent:


After the data is sent it will be received by a middle server that will write the object into a text file:

This message will be used as an input for the CCR translator that will transform it into CCR format will be saved as an XML document.

The resultant CCR will look like this:

```
<Problems><Problem><Type><Text>Symptom</Text></Type><Description><Text></
Text><Code><Value>K92</Value><CodingSystem>ICD</CodingSystem><Version></V
ersion></Code></Description></Problem></Problems>
```

And that will be saved in the server and can be accessed by medical stuff.

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