

National Identification Number, Integration of Pathology Laboratory, Cloud Computing and mHealth

Arvind Rehalia,
Research Scholar
Lingaya University

S V A V Prasad, Ph.D

Dean (R&D), Lingaya
University Faridabad

ABSTRACT

Medical services are the most vital services for all of the people around the world. Provision of health care services has increased in recent years but still there is acute scarcity of the specialists and health services and health care providers. So there is need of wireless technology in the health services like telemedicine, mHealth etc.. Still in various areas the health records are of paper type which are having the chances of getting lost and are available at different places. So this brings in the need for centralized health records system that are called electronic Health Records. In this paper we will be focusing on the benefits and role of mHealth in providing health services to the society and its brief integration with the national identification number bring above. The use of electronic health records offers significant benefits in health care units. Direct access to patient history, lab test, reports, and imaging from the point of care eliminates the delay required for medical attendants to dispatch and retrieve records from distant locations.

General Terms

mHealth , NID, UID, EPR, Cloud Computing

1. INTRODUCTION

mHealth

mHealth system will provide basic medical services to world using mobile, Tablet PC and other handheld devices. mHealth is the demand of time [3]. Working person, elder people, physically handicapped people are not able to visit doctor for every time (post-operative treatments). People lying in hilly, remote, slums and other areas where there is scarcity of health workers there mHealth will be ray of hope for them. The mHealth system combines portable biomedical instruments (PBI) with advanced telecommunication systems where PBIs are based on low power mixed signal microcontroller and wireless devices allow medical staff with basic training to install and record the vital signals of patients on remote locations, on the move and at small clinics for on-line tele-consultation [3]. The mHealth services will be available to the patients depending on demanded services, locations and availability of telecommunications systems.

Why mHealth

In recent years the field has emerged in an important application all over the world. Mobile has created a new boom in the society. There are more than 6 billion mobile users around the world. The number of mobile phone subscriptions in India will reach 993 million by 2014. Nearly 80% of the world population will be having mobile handsets by the end of 2013

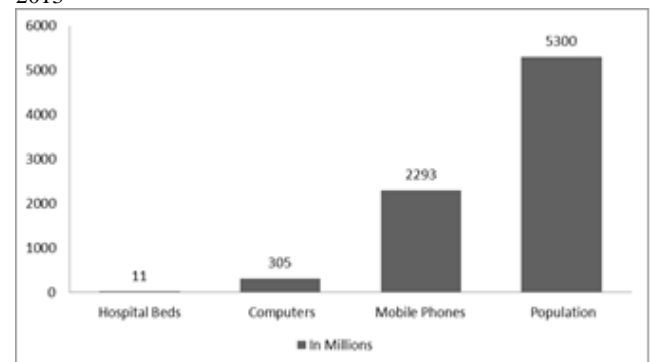


Fig.1. Technology and health infrastructure statistics for developing countries (in millions) [United Nations Foundation, 2009]

Patient id / National Identification Number

Many countries now days are providing a unique number to every citizen of his country like national identification number, national identity number, or national insurance number, unique identification number (UID). These are used for various purposes like tracking the permanent residence of their citizen, taxation n work, polling and other government benefits. This number will be available on identity document issued by a particular country. This can be issued to other country citizen also when he is granted temporary or permanent residence in the country. These identifications use biometric identifications like Iris scan, Finger print and Identity proofs.

This number is issued at two points

- At the time of birth
- At legal age i.e. 18 year

Every citizen in Belgium has a national number, the number is created using the date of birth of the country citizen (encoded in six digits), followed by a serial number (three

digits) and a checksum (two digits). In Bulgaria every citizen has 10 digit uniform civil number. This code was generated with the reference to the persons date of birth. Females are identified with the odd number and males are identified by even number. In Canada citizens are provided with Social insurance number (SIN) It provides all details of the citizen . In Chile, the national identity is provided by RUN (ROI Unico Nacional) . This number is used as national identity, tax payer number , social insurance number, passport number , driven license number and employment number. Chinese government issues a 18 digit identity number to their citizens. All these number are issued at the age of 18 years.Colombia government provide Id number at the time of birth with short serial number at the age of 18. They issue a new card cll citizenship card and Id number to them.

In India the government has issued PAN numbers to the citizens for dealing with the taxation purposes. This PAN number is used as ID for purchasing a telecom number. These days the Indian government is working on its UID project. Government is providing 12 digits ID number to every citizen of India. This project is named as AADHAAR. This card can be used to provide proof of identity and address anywhere in India. Any person who is citizen of India irrespective of their age, gender , caste , creed, religion can apply for this card.[7]

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In Chile the national identity is provided by RUN (ROI Unico Nacional) . this number is used as national identity, tax payer number , social insurance number, passport number , driven license number and employment number. Chinese government issues a 18 digit identity number to their citizens. All these number are issued at the age of 18 years [8].

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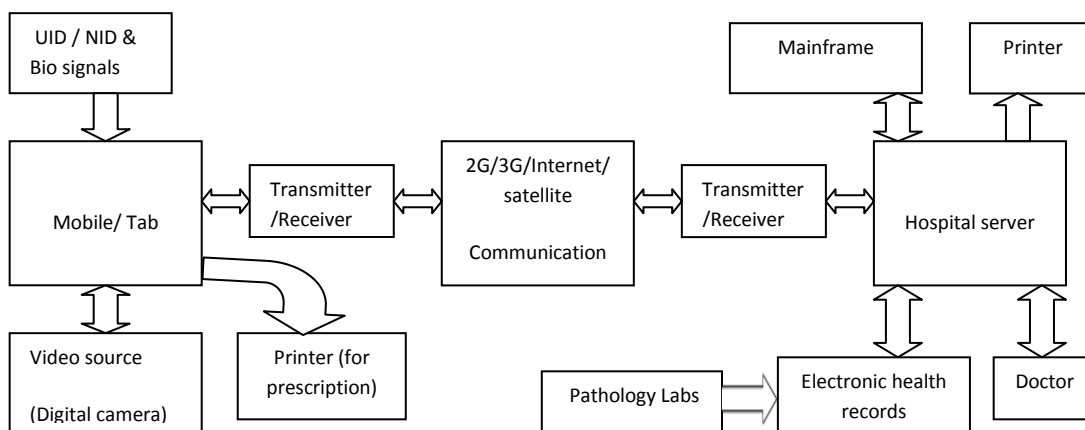


Fig.2 mHealth model

Roman in which these guidelines have been set. The goal is to provide Patient id / National Identification Number

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Biosignals

Bio signals are the signals received from the portable

biomedical instruments. There will be non-invasive sensor for detecting human disease. PBI means portable biomedical instruments are used for receiving bio signals from the human body[8].

Videosource

In case of 3G we can transmit video signal also which can help the doctor in proper diagnosis. In other case we can send the clip of the patient using MMS.

Printer

Printer is used on both sides at the remote end and the hospital end for the printing purposes.

Analyzer

Analysers here are specialists or the doctor who will diagnose the disease in the patient and using mHealth for his post give the prescription according to the patient conditions.

Mainframe

Mainframes are mainly powerful computers used by corporate and government organizations for big applications, bulk data processing. Here it is used for the storage of data i.e. electronic health records. Data can be saved on clouds.

The term cloud engineering was introduced officially in April 2009. It is a field of interdisciplinary engineering. Cloud computing directly provides the service over the network. There are various types of service models of the cloud. IaaS known as infrastructure as a service. This is the most basic type of cloud service model. It will provide virtual machine, server, storage, load balances, network etc. The other one is PaaS known as platform as a service. This model will provide computing platform mainly operating system, programming language, execution environment, database and webserver. Its examples are Force Com, Google app engine etc.. The other one is SaaS means software as a service. This will provide software facilities. Using this user can install and operate application software in the cloud. The main examples are Google apps, Microsoft Office 365 etc. NaaS means the network as a service. With the help of this client can use network / transport connectivity services and/ or inter cloud network connectivity services. NaaS include virtual network services[10].

Cloud has some deployment models. The first one is public cloud. This provides the storage for general public by service provider. Generally public cloud services are Amazon AWS, Microsoft, Google. Community cloud shares the infrastructure between several organisations; hybrid cloud composed of two or more clouds (private, community or public). Last one is private cloud, its infrastructure operates solely by single organisations. It helps in promoting business [10].

Image formats

An image is a two-dimensional signal. Image is the pictorial representation of memories. An image file format can store

data in uncompressed, compressed and vector formats. There are various kinds of digital image formats supported by the mobile. Tagged Image File Format (TIFF) .tiff, .tif, Joint Photographic Experts Group (JPEG).jpg, .jpeg, Graphic Interchange Format (GIF).gif, Portable Network Graphic (PNG).png, Windows Bitmap Format (DIB).bmp, .BMPf, Windows Icon Format .ico, Windows Cursor.cur, XWindow bitmap .xbm [3].

Electronic Health Records (EHR)-

An electronic health record (EHR) which is sometimes also called as electronic patient record (EPR) is a concept which can be defined as an organised and systematic collection of patient's health information electronically. It is a record in digital format and is capable of being shared across different health care units with the help of network connected information systems. These records generally include a whole range of data including their basic details or demographics of patient, their medical history, medication status, allergies, laboratory test results, radiology images, vital signs or symptoms of the disease [1].

The utility of EHR can be understood as a complete record of patient that allows streamlining of the workflow in health care units and increases the services which can be provided to the patient by the health care unit in order to save his life.

An EHR is generated and maintained by an institution (health care units) such as a hospital, clinic, or physician office. Mainly commercial EHR systems are designed to combine data from the large health service units such as pharmacy, laboratories and radiologists[4].

The primary purpose of an electronic health record is for continuous and safe care of the patient. The EHR enables the attending health care professional to provide effective and continuous care and to determine the patient's condition at any given point of time [3]. It also helps physicians in performing all the activities which they perform with the help of paper records.

Secondary purposes of these records are research/historical, epidemiology/public health, statistics, education, utilization studies, quality assurance, legal document (used as evidence) and healthcare policy development [5].

Electronic clinical documentation systems increase the value of EHR by providing electronic capture of clinical notes, patient assessments and clinical reports, such as medication administration records (MAR). The documentation can include-

- Doctors, Physician, nurse, and other clinician notes
- vital symptoms, problem lists, diagnosis
- Discharge summaries and procedures and bills
- Consents in case of surgeries
- Past and present medical records

Pathology Laboratory

Quality in work, accuracy in results, reliability patient service with care and understanding and bringing value to diagnostic needs of the society. Pathology laboratories are the laboratories used for the best diagnostic in world for complete health check-ups, blood test like blood count test, blood group testing, urea, diabetes etc. These laboratories are the most important part of the medical science. These labs help in checking the condition of the patient before treatment. There are various kinds of test for various organs and various parts of the body. Pathology laboratories are Test laboratories are labs where patient go for having test of his body e.g. blood glucose, urine test, ESR etc. when doctor prescribe the patient for these tests. There are various kinds of test taken world-wide Cardiologist, Dermatologist, Diabetologist, Endocrinologist, Gastroenterologist, Genetic Disorder, Gynaecologist, Haematologist, Infectious Disease specialist, Nephrologist, Neurologist, Oncologist, Ophthalmologist, Paediatrician, Physician, Psychiatrist, Rheumatologist, Surgeon.

Laboratory services encompass of clinical pathology routine biochemistry, special chemistry, immunoassays, microbiology - bacteriology, mycology & Mycobacteriology, Hematology, serology, histopathology, indirect immunofluorescence, cytopathology, clinical research services. Radiology department mostly needs reports like ultrasound, colour Doppler, bone densitometry, mammography. cardiology department need ECG, (electrocardiography), TMT, treadmill test (stress test), PFT, pulmonary function test, stress echocardiography (exercise) [2].

Reliability

Reliability is the main requirement of the system. There can be lot of human error in the system. We have to make the data more reliable. If the information available on the system is wrong then the prescription will be wrong. This can create a problem for the patient. The data will be updated by the technical support officer at the state level only. Proper system tests will be performed for checking the reliability of the system.

Security of data

Security of data is important. Data is accessible to the registered doctors only. The data should be more secure. Various layers will be developed and types of information security control are appropriate to databases. These mainly includes, Auditing, Authentication, Application security, Encryption, Integrity controls, Backups, Access control.

Fast access to data

As this is big data base. The system will be very heavy. Data mining should be fast so that patient can be treated well in time. We can use algorithms, optimization technique to make system fast.

Communication link

2G

2G (or 2-G) is known for second-generation wireless telephone technology. Three main benefits of 2G networks over their older one was its digital encryption of the phone conversations done in 2G, 2G systems were significantly more efficient for spectrum, allowing for more mobile phone penetration levels, and 2G provides data services for mobile, like SMS text messages. 2.5G, 2.75G were the new technologies come after 2G with more facilities. These are still used in many parts of the world [12].

3G

Third generation mobile is also available in various cities of World. We can use 3G dongle for having internet facilities at village end. 3G or 3rd generation mobile telecommunications is based on the International Mobile Telecommunications-2000 (IMT-2000) [15].

Wi-fi

Wi-fi provides wireless internet facilities. It follows IEEE 802.11 standards. It is commonly used in WLAN. Many user can use the Wi-fi connections at a time. Wi-Fi network can be accessed on mobiles, smart phone, PCs, tablet PCs. It has a range of about 20m indoor. It has much range outdoors.

Wimax

WiMAX commonly known as worldwide interoperability for microwave access. It's kind of wireless communications. It's a part of fourth generation of wireless communication. It can provide 1 Gbit/s for fixed station. With this technology we can provide data with signal radius of 50 km. WiMAX can provide digital subscriber line (DSL) telecommunications (VoIP) and IPTV services to the users [15].

Satellite communication

One of the most important type of communication technique used these days for transmission. Geostationary satellites are used for this work. The geostationary satellites are placed at the height of 36000 km above the equator. The communication is done in microwave frequency band C: 4/6 GHz and Ku band having frequency at 11/14 GHz.

2. Research Methodology

In various areas in country we are using paper base health record system. Many of the patients lost their disease history and health reports. Test reports will be directly uploaded on the server from the laboratory. For this we develop electronic health records of everybody. For this we will follow following step.

Step 1: Electronic health record management at medical college level [11]

The first step for the EPR development will be at college level. This will be done with the help of high configuration computer i.e. ROM, RAM, advanced processors, hard disk, fast internet access using broadband, 2G, 3G, Wi-fi, Wi-max, VSAT etc. The development of health records need software like oracle, SQL etc. Whole world will be divided on the basis of medical colleges. Like in India we have 28

states. Himachal Pradesh is a state in India. There are two medical colleges in the state. State will be divided in two parts. This can be done on the basis of number of villages or

number of districts. As in this state there are 12 districts i.e. one medical college will make EPR for six districts. All the medical detail of every person will filled using his national identification number. The medical college will make back up for his data [8].

Step 2: Data at the state/ country server and world server

After completing the EPR at the medical college level. A state server will be developed on the basis of data available at the medical college level, Where the health record of each and every person of the state will be stored. Every state will

loaded without any human interference. Analytical test or non-computer operated tests will be uploaded by the pathological laboratory operator. There will be no need to print the report except in some exceptional cases[11]. The same

medical college will upload pathological reports the patient who has made the EPR of the patient. The state level server, country server and world level server will be developed on the basis of data available in the medical college servers. From the world server all data will be available with the registered doctors all over the world and ambulatory services and ships in sea. These data will be available on all type of handheld devices used in mHealth like mobile, smart phones, PDA, iPad, tablet PCs, Laptop and computers online using broad band, 2G, 3G, Wi-Fi, Wi max etc[9].

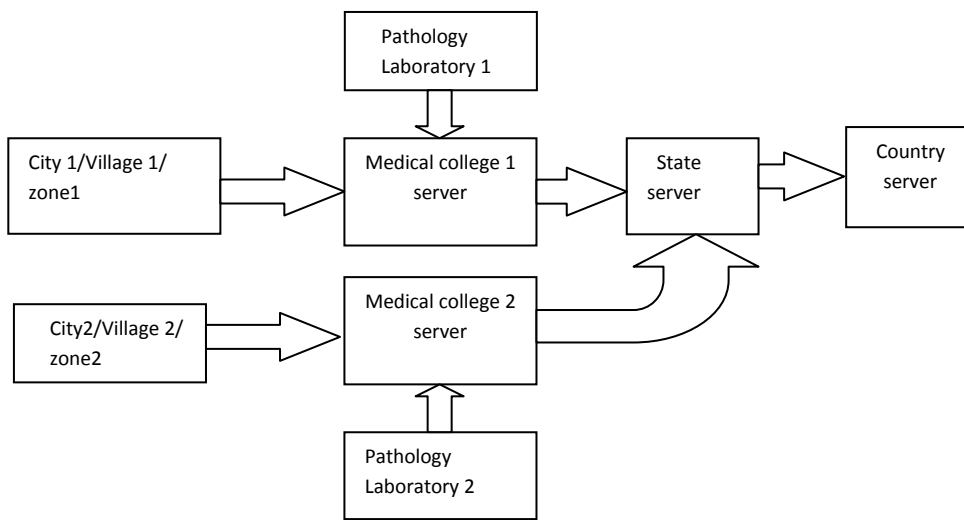


Fig.3 Data base preparation

treatment anywhere in world without carrying medical test reports and old prescriptions[11].

Step 3: Uploading of Pathological laboratory reports

After completing the EPR at world level. Further pathological reports can be uploaded to the server. The reports will be send online to the operator and after verification operator will be having its own server at the state level and its back up. After state server data will be send to country server, all country's data will be saved in world server. All these server will need computer with very good configurations like high value of Random access memory, Read only memory, advanced processor, internet connections, database software like Oracle, SQL, MySQL etc. With the help of this, patient can get treatment anywhere in world. There will be on one EPR for every person on the world and every body can get upload it to EPR using identification number. The test which are non-invasive and computer operated will be directly

Step: 4: Updating of the health records

After studying the patients data, doctor will send the prescription to the patient and the patient's parent medical college through email, sms or any electronic means, and the operator in the medical college will update the data in the health records database. This can be done using joint photographic expert group, using eHealth network etc.

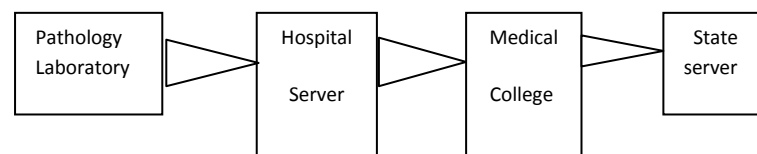


Fig.4 Upgrading EHR

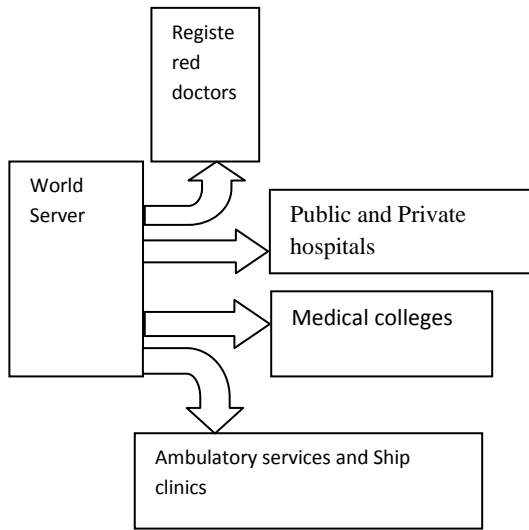


Fig.5 Access of the electronic health records

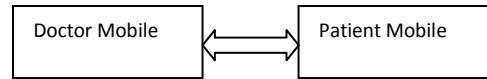


fig .7 Updating of data

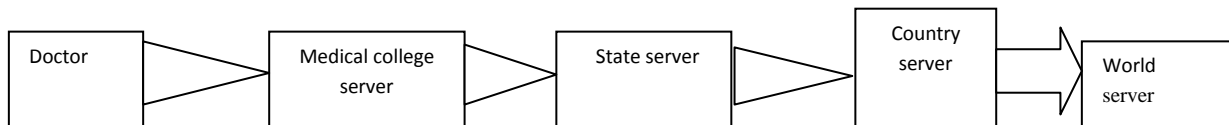


fig .6 Updating of data

3. Whole process

Patient:

Patient has to go to the hospital. He has to fill the form in the hospital with his national identification number. That form is given to the receptionist. Receptionist will give a slip to the patient on which following information will be given.

Registration: Name: Sanjeev Kumar

Patient mobile: 98172896xx

NID / UID: 21589632548

Operator mobile number: 97165000xx

Operator mail: sui1987@rrrmail.com

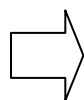
Doctor name: Dr Rajesh

Doctor mobile number: 94165000xx

Doctor mail: arty@rtyumail.com

The doctor number will vary according to the specialization of the doctor.

After first meet patient has to be in touch with doctor for post-operative treatment. Patient will send the data to the doctor's



mobile and operators mobile. All pathological reports will be send directly to the operator through email or he can enter the data directly on the server .

Data will be updated by the operator in the EPR after complete verification. After updating data will be available on the servers. Doctor will reply his suggestions to both operator and the patient. Operator has to upload doctors suggestions on the server The ERP will be available on the registered doctor PC world [11]

Merits

- This system will help us to provide medical facility in every part of the world.
- This system will provide job to opportunity to the society
- This system will help in checking the number of patients of particular disease like HIV, cancer, Polio etc.
- This system will help in removing various diseases from the world.
- Patient does not need to revisit doctor
- This system will remove the chance of human error in the system
- This system will provide all the report online
- Patient does not need to carry reports

Demerits

- Used only for pre and post-operative treatments
- If data is wrong then prescription will be wrong
- Some technical knowledge is required to the patient
- X- Ray, CT scan and ultrasound cannot be uploaded yet.

4. Conclusion and Future Scope

This type of projects help in reducing epidemics from the society. This will develop concept virtual hospital in the society. This will help the elder people a lot and create a health revolution in the society.

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