

# Technology Embedded in Healthcare

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**Abstract-** The adoption of EHR system is important as it provides a proven, structured and cost effective process that will lead to better patient outcomes, better information at the hand of healthcare staff's, and better healthcare analytics to improve patient care. Advance health care directives enable a person to appoint a health care agent to make treatment decisions and/or to provide specific instructions regarding potential treatments so that health care providers can administer care in accordance with the patient's choice. The ultimate goal should be to improve quality, increase efficiency and add convenience. These systems allow patients to inform future medical care decisions even after becoming incapacitated. With the proposed system of HER, doctors can provide, Better, Safer Patient Care. Doctors can enter prescriptions directly into computers, aided by the Clinical Decision Support System, which helps ensure correct doses, and avoid drug interactions and allergies. This system also help to pharmacists not to decipher doctors' handwriting and can instead focus on providing timely prescription reviews. By the use of this system, one can eliminate human errors in dispensing. In addition, our system helps the clusters enhance the patient experience through use of mobile technologies in the today's mobile world. This system enables easier information access for patients, clinicians and administrators at all points of care.

**Keywords:** E-Healthcare, Electronic Health Records (EHR), Web Services, Mobile Technologies.

## I. INTRODUCTION

Healthcare is a field in which accurate record keeping and communication are critical and essential in which the use of computing and networking technology lags behind other fields. For good healthcare system the accurate record keeping and communication are essential. Current communication mechanisms, based largely on paper records and prescriptions, which are old-fashioned, inefficient, and unreliable. In today's world of digital and electronic, record keeping and communication in the healthcare industry is still tied to paper documents that are easily mislaid, often illegible, and easy to forge. To improve this process, the prescriptions could be communicated electronically from the physician to the pharmacist, physician to Patient, physician to laboratories and physician/pharmacist to any other healthcare professionals electronically.

According to Carmen Catizone of the National Association of Boards of Pharmacy, there are as many as 7,000 deaths from incorrect prescriptions in the United States per year. A Washington Post article indicates that as many as 5% of the 3 billion prescriptions filled each year are incorrect. These numbers indicate that there is an urgent need to reduce the errors in traditional healthcare system. A modern

electronic healthcare system based on the current computing technology [1] can address some of these issues and problems.

Healthcare ecosystem consists of the healthcare providers (doctors, physicians, specialists, etc.) and payers like health insurance companies, pharmaceutical companies, IT solutions and services firms, and the patients. The process of provisioning healthcare involves massive healthcare data which exists in different forms on different data sources such as relational databases, file servers, etc. and in different formats also. By using our proposed system, when a patient is admitted to a hospital, his/her information is entered into electronic health record (EHR) systems. Physicians diagnose the patient and the diagnostic information (from medical devices such as CT scanners, MRI scanners, laboratory tests, etc.) is stored in EHR systems. In the diagnosis process, the doctors retrieve the health information of patients and analyze it to diagnose the illness. Doctors can take expert advice by sharing the information with consulting specialists [2].

There are different forms of HIT, many of which are widespread: Suppliers of pharmaceuticals and medical equipment are often completely wired, including large pharmacies. Virtually all kind of billing using this software hospitals and pharmacies is done using computers. Hospitals use computerized systems to track supplies, account for profits and losses, control inventory and process payroll. Results for diagnostic images are stored electronically i.e. HER and often shared with radiologists half a world away. Disease databases on clinical trials are widely available on the Internet. Yet, EHR's are not in widespread use, despite being often cited as the technology with the greatest potential to improve quality and reduce costs.

Advanced Computer Technology use by Hospitals and Physicians for Hospitals Administration, Administrative and financial Patient billing, Accounting systems, Personnel and payroll, Materials management, etc. Clinical Data stored by our system electronically include Order entry for drugs, Receiving lab results and other clinical information online, Electronic health records, Diagnostic image archiving Lab results, Clinical decision support systems, Prescription drug fulfillment, E-mail communication with patients, etc [3]. If we go to the hospital administration particularly, all the needed infrastructure consisting of Personal computers, Servers and wireless network routers, Information security systems are all needed.

A main advantage of storing patient records electronically is that it can make distance patient care for some physician consultations [4]. In addition, some consults may be simple enough to be done by any physician who has reviewed

a patient's medical records. Thus, EHR system may offer patients improved access to care [5].

## II. WORKING OF OUR E-HEALTHCARE SYSTEM

Our e-healthcare system uses basic software architecture principles and provide interoperability between different computing platforms and applications that can communicate with each other. We develop clinic, pharmacy, and patient modules that provides the actual services for the distributed e-healthcare system. All type of devices like desktop or server computers, PDAs or smartphone can access all of these modules. The electronic medical devices, such as blood pressure monitors, pulse rate counter, etc can also be attach with this system. Our prototype provides user-friendly interfaces for busy healthcare professionals and patients, with security and privacy in mind. For this system authenticates users and logs session information and attaches resources to the resource creator, so that only privileged and authentic users can view or modify the data. For applications, based on different operating platform runs properly and authentically with our system.

The clinic module supports main routine activities of physicians and nurses at the clinic by maintaining information such as appointments, fees, prescription, notes, etc. In our e-clinic shown in below figure, we designed a Web server interface for users i.e. physician or nurse and patients to access the clinic module and perform their respective task. Patients, from a desktop computer, PDA, or using their smartphone can use the web server interface to request appointments with the physician for a specific date and time, saving time in today's world of busy schedule [6]. Applications and devices such as electronic blood pressure monitors, glucose monitors, weighing scales, and so forth by using this web services can communicate with the clinic module and transmit information to a desktop or laptop computer via a wired or wireless network and then to the clinic Web service over the Internet.

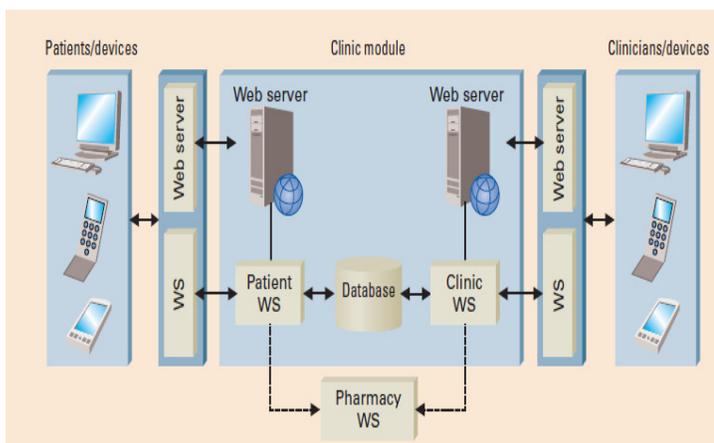
Fig.1: E-clinic module having web service interface to patients and other applications.

The EHR facility sends prescriptions from the physician to the pharmacy over the Internet reducing the workload of both man and mind. Communication between the physician and the pharmacy occur with the pharmacy in our registry. Our e-healthcare system would follow electronic prescription standards once they're adopted and widely used. The physician is able to use a PDA to enter and retrieve information about the patient during or after an appointment and to access the information later at any time. The computer can communicate with a desktop or server using wireless connections. The accuracy is ensured as the physician must confirm the prescribed medication and its dosage upon entry as such information is critical to the patient's life. Integration with pharmaceutical applications or laboratory applications with web services that warn of interactions between medications can further improve the provided service's accuracy.

The Web server interface to our e-healthcare clinic can give opportunity to patients to request an appointment with a physician for a specific date and time using the clinic Web server. In this patient-centric system, the patient can both see his or her appointments with the physician and can access his personal information. The Web server interface to the pharmacy server lets a patient check the status of a prescription, view his or her prescription history, and renew existing prescriptions, etc. If the patient requests a prescription to be filled at the Web site, he or she can see total billing amount, can make a payment. The pharmacy module sends reminders to the patient about the status of the patient's prescriptions as well as sends messages related to patients' prescription.

To assess and report the patient's health status, the system can scale to support the use of medical monitoring devices like an electronic blood pressure monitor to report periodically or, in emergencies, to send an alert immediately. The system transmits information along with the device's serial number, whose history is already registered and the clinic Web service makes the association with the particular patient. The data is then communicated over the Internet to the clinic web service for physician examination by the physician.

This system according to expertise and customer allows us to develop deeper skills in areas such as EHR, radiology and laboratory systems, standards, healthcare analytics, finance, billing and human resource, for our customer focus to ensure the right solutions for them. This deep healthcare-IT knowledge and collaboration with our clinical users were critical to the delivery of the Central Clinical Data Repository database system, Computerized Physician Appointment Entry, Radiology Information System, Results Reporting, Closed Loop Medication Management and Clinical Decision Support systems for the various clusters and their institutions. Virtualization and cloud computing technologies



have been used to optimize the healthcare clusters' IT infrastructure, expand data center capacities, reduce costs and harness the full benefits of consolidation.

### III. FACILITIES GIVEN BY E-HEALTHCARE SYSTEM

#### A. Enable Care for Healthcare ecosystem

The integrated care systems such as our e-Healthcare must enable caregivers to manage patients and access relevant data across various settings – from acute care hospitals to community hospitals, nursing homes, polyclinics and general practitioners with all sort of services they can provide to us as Medical, Pathologies, Radiology's, etc [7]. To facilitate these, we will have to assist with the implementation of powerful database and Facilitate Care Beyond Hospitals. Our system try to enable patients' use of home monitoring devices that can feed data to the systems. Online services and patient portals will also be set up to increase patients' access to information. In addition, our develop system can be supported by mobile platform so patients can use smartphones and other devices to access their health records or care services.

#### B. Paperless Medical Centre

Our system mainly supported for the Electronic Medical records so the past medical repositories based on paper, saves both environmental and personal work. Besides the past Electronic Clinical Documentation program, we are designing to implement systems to convert patient paper records into electronic copies, and forms. This Electronic Medication Record system can help inpatient to give doctors 'anytime anywhere' access for medication ordering. The integration of EHR system with the Critical Medical Information System (CMIS) [7] for drug allergies, adverse drug events and medical alerts will further enhance patient safety. For the Outpatient Prescription System we are planning to develop an upgraded electronic prescription system for doctors of the outpatient clinics and polyclinics. The program has a drug dictionary and other possible useful features compatible with the inpatient medications system, and will give the way for more advanced clinical decision support modules.

#### C. Clinical Documentation System (EHR)

In our e-healthcare system, we will roll out the Clinical Documentation system allowing the doctors to enter electronic patient consultation notes more efficiently, and eliminating paper files. By this system, doctors enable the to quickly record the patient's description of his/her condition, the doctor's observations and diagnosis, and prescribed medication and treatment [8]. By using this system hospital can provide electronic prescriptions, discharge summary, future notes, etc., electronically.

#### D. Integration with Cloud Computing

E-Healthcare systems can establish a profile for each individual patients. As the population grows, a huge amount of data will be collected and stored on trusted e-Healthcare servers. At the same time, the servers must facilitate efficient and secure access from system users so that they can monitor and manage their own health information. Therefore, reliable and robust data servers with large storage capacity and strong computing capability are required to store, process, and distribute health information [2]. The emerging cloud-computing concept fits well in this scenario. And our designed is scalable to integrate with this cloud environment. Cloud computing is an evolving paradigm that enables ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources that can be rapidly provisioned and released with minimal management effort or service provider interaction [9].

### IV. USES OF ELECTRONIC HEALTH RECORDS

Meaningful use of our e-healthcare system can be broadly summarized as follows [10], [11].

- As using EHR all records are stored in database then this database can be used to treat other patient if possible. For example, cardiovascular disease and diabetes assessment and management systems in which data fields are automatically pre-populated from the patient's EHR and are risk-assessed, and management options are saved back into the EHR to deliver patient-specific, evidence-based advice at the point of care.
- The electronic referrals to hospitals, the hospital can define the information it wants about the patient and the GP's EHR automatically extracts and sends relevant information, including appended reports. This system is transforming the GP-hospital interface. About 80 percent of the content of electronic data is common across all types, but the other 20 percent varies according to specialty type.
- By using this e-healthcare system, when patients are referred by GP to a hospital, the hospital staff and GP have electronic access to notes and examinations from all other hospitals the patient has visited.
- Home care is automatically notified when a patient is admitted to a hospital and discharged. Information about the patient's status at discharge is included.
- Medication information from GP EHRs is stored in a web database and can be accessed by all hospitals.
- When patients are transferred from one hospital to another, the EHR information can be accessed by both hospitals.

- Shared EHRs system facilitate care planning among primary, secondary, and long-term care settings by using SMS and Email facilities.

## V. CONCLUSION

In conclusion, as all the world is becoming digital, which mainly done by current developing Information Technology. So, by applying advanced communication networking and sensing technologies to healthcare, e-Healthcare can improve our living standard at low cost. This note presents several challenging issues, which are critical for patients health, are trying to be resolved by advancing e-Healthcare systems. The concept of EHR as emerging technologies will also make our healthcare system remotely faster. The remote monitoring devices is expected to be a very useful technology with potential to offer a wide range of benefits to patients, medical personnel and society through continuous monitoring and early detection of possible problems. The current technological evolutions will bring us closer to anelectronicsystemfor managing any patients form anywhere by anyone acting as an enabler for improving the Quality of Life

## REFERENCES

- [1] A Distributed e-Healthcare System Based on the Service Oriented Architecture Kart, F. Gengxin Miao Moser, L.E. Melliar-Smith, P.M. Dept. Of Electr. &Comput. Eng., Univ. Of California, Santa Barbara, CA;
- [2] A Cloud-based Approach for Interoperable Electronic Health Records (ehrs) Arshdeep Bahga and Vijay K. Madiseti, Fellow, IEEE.
- [3] Source: "Report to the Congress: New Approaches in Medicare," Medicare Payment Advisory Commission, June 2004, Table 7-1, page 159.
- [4] For a discussion of telemedicine, see Devon M. Herrick, "Convenient Care and Telemedicine," National Center for Policy Analysis, Policy Report No. 305, November 2007.
- [5] Paul C. Tang and David Lansky, "The Missing Link: Bridging the Patient — Provider Health Information Gap," Health Affairs, Vol. 24, No. 5, September/October 2005, pages 1,290-95.
- [6] L.E. Moser and P.M. Melliar-Smith, "Service orientedarchitecture and Web Services," Wiley Encyclopediaof Computer Science and Eng., Wiley & Sons, 2008; <http://mrw.interscience.wiley.com/emrw/9780470050118/ecse/article/ecse510/current/abstract>.
- [7] transforminghealthcarewith IT Innovation [Online] available:[https://www.ihis.com.sg/mediacentre/publications/Documents/ihis\\_Yearbook.pdf](https://www.ihis.com.sg/mediacentre/publications/Documents/ihis_Yearbook.pdf).
- [8] Research Insights [Online] available: <http://www.academyhealth.org/files/publications/ahusingevidence2012.pdf>.
- [9] THE ADVANCEDMEDICAL HOME:A PATIENT-CENTERED,PHYSICIAN-GUIDEDMODEL OF HEALTH CARE [Online] available:[https://www.acponline.org/advocacy/current\\_policy\\_papers/assets/dv\\_med.pdf](https://www.acponline.org/advocacy/current_policy_papers/assets/dv_med.pdf)
- [10] D. Blumenthal and M. Tavenner, "The 'Meaningful Use' Regulation for Electronic Health Records," New England Journal of Medicine, Aug. 5, 2010 363(6):501-4.
- [11] D. Protti and I. Johansen, Widespread Adoption of Information of Technology in Primary Care Physician Offices in Denmark: A Case Study (New York: The Commonwealth Fund, March 2010).