ANALYSIS ON HEALTH INFORMATION EXCHANGE CDA GENERATION AND INTEGRATION BASED ON CLOUD COMPUTING SYSTEM

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ABSTRACT
A successful implementation of an electronic health record can enhance patient safety and the standard of care, but interoperability across hospitals' HIE systems is a need. The spread of this document format is essential for interoperability, and the Clinical Document Architecture (CDA) created by HL7 is a fundamental document standard to assure such compatibility. Sadly, hospitals are hesitant to embrace interoperable HIS because of its adoption costs, with the exception of a small number of nations. As all hospitals switch to the CDA document format, further issues appear since it is challenging to handle the data spread throughout so many papers. In this article, we discuss our cloud-based Open API service for CDA document production and integration, which enables hospitals to quickly produce CDA documents without having to buy software. Our CDA document integration system integrates multiple CDA documents per patient into a single CDA and physicians and patients can browse the clinical data in chronological order. Our system of CDA document generation and integration is based on cloud computing and the service is offered through Open API. Developers using different platforms thus can use our system to enhance interoperability.

1. INTRODUCTION

A longitudinal collection of health information that includes the patient's health, the healthcare that was delivered to that patient and the patient's response to that treatment can be recorded as electronic health information, creating an electronic health record (EHR). Thus, the HIE system's deployment is designed to guarantee the EHR's successful upkeep. But, there is also an issue with system incompatibility, because HIS has a variety of features. In order to ensure interoperability with regard to health information, it is necessary to standardize the sharing of health information across hospitals. Hence, standardizing the clinical document is essential to ensuring interoperability. The major standard for clinical documents is CDA which was established by Health Level Seven (HL7). CDA is the core document standard, an XML document which holds the structure and semantics of clinical documents for health information exchange. The first version of CDA was released on 2001 and it's second version was released on 2005. Many countries have done many successful projects adopting CDA. To improve semantic interoperability, many active works are done based on openEHR and CEN3606.

More HIE system has to support CDA to establish confidence in interoperable Health Information Exchange. Moreover, the structure of CDA is too complex and the correct CDA Document production is difficult without the good understanding of the CDA standard and enough experience with it. Also, the HIS development platforms for hospitals differ so greatly in such a way that generation ofCDA documents in every hospital invariably requires a separate CDA generation system. In addition to that, hospitals refuse to adopt a new system unless it is perfectly necessary for delivery of care. As a result, except for only few handful countries like New Zealand or Australia, the adoption rate of EHR is too low. To promote HER adoption among hospitals, the USA government had implemented an incentive program called the Meaningful Use Program.

When a patient is diagnosed at a clinic, a CDA document the diagnosis is generated. The CDA document can be share with other clinics if the patient agrees. The concept of family doctor does not exist in Korea; hence it is common for a patient to visit a number of different clinics. The exchange of CDA document is triggered in the following cases: when a physician needs to study a patient’s medical history; when referral and reply letters are drafted for a patient cared by multiple clinics; when a patient is in emergency and the medical history needs to be reviewed.

It takes increasing amount of time for the medical personnel as the amount of exchanged CDA document increases because more documents mean that data are distributed in different documents.

Thisdefinitely delays the medical personnel in makingdecisions. Therefore, when all the CDA documents areintegrated into a single document, the medical personnel aremotivated to view the patient's medical historyconveniently in chronological order per clinical section and the corresponding care service can be provided moreeffectively. Sadly, for now, a solution that integratesmultiple CDA documents into one do not exist yet to the best of our knowledge and there is a practical limitation forindividual hospitals to develop and implement a CDA document integration interface.

In this paper we show (1) a CDA document generationsystem that generates CDA documents on differentdeveloping platforms for the interface to be platformindependent and (2) a CDA document integration systemthat integrates multiple CDA documents scattered indifferent hospitals for each patient.

2. LITERATURE SURVEY

A Prototype Model Using Clinical Document Architecture (CDA) with a Japanese Local Standard: Designingand Implementing a Referral Letter System.In this paper, since clinical document architecture (CDA) became an American National Standards Institute (ANSI)-approved health level seven (HL7) Standard, many countries have begun making an eff ort tomake local standardsconform to CDA. In order to make CDA compatible with the many different local standards existing in differentcountries, we designed a prototype model using HL7 CDA R2 with medical mark-up language (MML).

Application of Portable CDA for Secure Clinical-document Exchange.Health Level Seven (HL7) organization published the Clinical Document Architecture (CDA) for exchanging documentsamong heterogeneous systems and improving medical quality based on the design method in CDA. In practice, althoughthe HL7 organization tried to make medical messages exchangeable, it is still hard to exchange medical messages. Thereare many issues when two hospitals want to exchange clinical documents, such as patient privacy, network security,budget, and the strategies of the hospital. In this article, we propose a method for the exchange and sharing of clinicaldocuments in an offline model based on the CDA—the Portable CDA. This allows the physician to retrieve the patient 'smedical record stored in a portal device, butnot through the Internet in real time. The security and privacy of CDA datawill also be considered.

3. MATERIALS IMPLEMENTED

In this section, we present the necessary techniques in detailfor the design, and explain the implementation of our CDAgeneration and integration system based on cloud

3.1 The CDA Document

American Nation Standards Institute approved the HL7Clinical Document Architecture Release 2 (CDA R2) in May2005, where CDA is an XML-based document mark-upstandard that specifies the structure and semantics ofclinical documents and its primary purpose is to facilitateclinical document exchanges between heterogeneoussoftware systems.

A CDA document is divided into its header and body. Theheader has a defined structure and it includes informationabout the patient, hospital, physician, etc. The body part isflexible than the header and contains various clinical data.Each piece of clinical data is allocated a section and given acode as defined in the Logical Observation Identifiers Namesand Codes (LOINC). Different subcategories are inserted in aCDA document depending on the purpose of the document,and we chose the Continuity of Care Document (CCD)because it contains the health summary data for the patientand it is also widely used for interoperability. We chose theKorean Standard for CDA Referral and Reply Letters(Preliminary Version) format for CDA integration system asthe number of clinical documents generated when patientsare referredand replies made, is large.

3.2 Cloud Computing

Cloud computing is defined as using a network of remoteservers, hosted in the Internet that helps to store, manage,and process data, rather than a local server or a personalcomputer. It refers to the applications delivered as servicesover the Internet and software in the data centres thatprovide those services. The user pays fee depending on theamount of resources allocated, such as network, server,storage, applications and services.

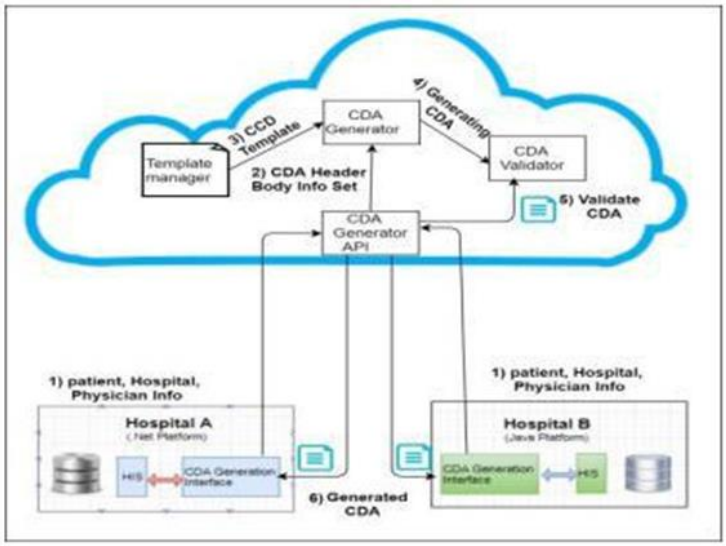

Fig-1 System Architecture

4. METHODOLOGY

The objective of our system is to generate the PDF format forthe generated and integrated CDA Documents for the use ofPatients. This conversion takes places in the CDA Generationand Integration Interface located in the HIS systems of thehospitals. Also, we have included another attribute in theCDA Header like Aadhar number applicable in India togenerate the unique ID in the cloud to create security ofinformation residing in the cloud.Our cloud computing based CDA generation and integrationsystem has a few pronounced advantages over other existingprojects. First, hospitals do not have to purchase proprietysoftware to generate and integrate CDA documents and bearthe cost as before. Second, our service is readily applicable tovarious developer platforms because an Open API is to driveour CDA document generation and integration system.Regardless of the type of the platform, CDA documents canbe easily generated to support interoperability. Finally, theintegrated CDA Documents is converted to PDF format.

4.1 Registration and Appointment

Users in the hospital environment will have an initialregistration in the web end. The server in turn stores theinformation in its database. Now the patient login and fixappointment to the Doctor by mentioning time and date ofthe appointment, disease, specialist and name of the doctor.Each Doctor views their appointment in their appointmentpage.

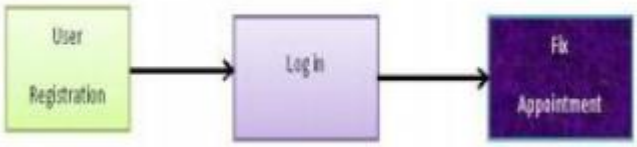

Fig 2: Registration and Appointment

4.2 Patient Report Generation

Doctor view the patient information such as disease,symptoms etc. If it necessary patient is advised to take labtest. Lab Technician provides test result to patient. Based ontest result, Doctor suggests prescription to the patient, andalso patient health history should be maintained inappropriate hospital database. Doctor can view patienthealth history before he suggests prescription to the patient.

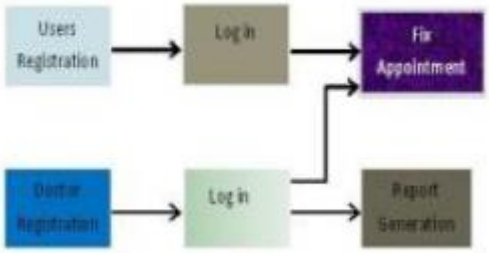

Fig 3. Patient Report Generation

4.3 CDA Generation

In this module patient health information's are send to thecloud server. Now the cloud server will generate unique idfor every user based on patient name, father name, date ofbirth and additionally Aadhar card number using PJW HashAlgorithm. If already id exists then the patient details will beappended with patient clinical history else new CDA document will be generated.

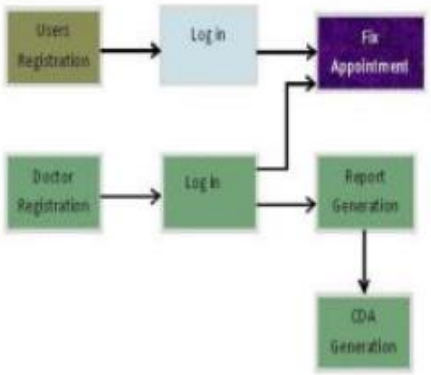

Fig 4.CDA Generation

4.4 Parsing CDA Document

In this module the new patient enters into hospital no need togive details about the disease and symptoms. The patienthistory already maintained in cloud server so we can get thepatient histories by using key it is retrieve from patientpersonal details. The patient histories maintained indocument which is contains patient clinical histories (hospital name, disease, prescription).

4.5 Converting CDA Document to PDF

The parsed CDA Documents are received at the HIS systemwhere the documents are converted into PDF for thepersonal use of the patient. To do this, we need to add anapplication called PDF conversion interface. This can besimply extended with the existing software where theentities like CDA Document Generation and Integrationresides.

CONCLUSION

We create a productive method of producing PDF files in the produced and integrated CDA documents for patients' usage. Our CDA generation and integration system, which is based on cloud computing, offers a few clear benefits over other ongoing programmers. When CDA documents proliferate and interoperability is attained, a difficulty arises because it becomes difficult to manage distinct CDA papers for each patient because the clinical data for each patient is dispersed over numerous pages. This problem is properly solved by our cloud server's CDA document integration solution, which combines different CDA documents created for specific patients.

First, Hospitals do not have to purchase propriety softwareto generate and integrate CDA documents and bear the costas before. Second, our service is readily applicable to variousdeveloper platforms because an Open API is to drive ourCDA document generation and integration system.Regardless of the type of the platform, CDA documents canbe easily generated to support interoperability. Also,additionally, the integrated CDA Documents of the patient isconverted into the PDF format for the use by Patients. Thus,the time is saved for the doctors in taking medical decisionsat emergency times and delivers the correct health care asthe medical records are in chronological order.

Future enhancement

In our future work, we will explore the following points.First, we will make a concrete estimation of the reduction incost when the EHR system becomes cloud-based.Establishing a reasonable fee system is an important issuefor cloud computing. There is ample evidence that cloudcomputing is effective and efficient in cost reduction, and themedical field seems to be no exception. Security and stabilityis top priority for cloud computing resources as it is used bymany users. Future work will attempt to enhance securitywhile ensuring reasonable quality of service even withmultiple users logged on the system at the same time.

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