

만성 질환환자를 위한 CDSS 를 적용한 PHR 시스템

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CDSS enabled PHR system for chronic disease patients

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Abstract

With the advance of Information Technology (IT) and dynamic requirements, diverse application services have been provided for end users. With huge volume of these services and information, users are required to acquire customized services that provide personalized information and decision at particular extent of time. The case is more appealing in healthcare, where patients wish to have access to their medical record where they have control and provided with recommendation on the medical information. PHR (Personal Health Record) is most prevailing initiative that gives secure access on patient record at anytime and anywhere. PHR should also incorporate decision support to help patients in self-management of their diseases. Available PHR system incorporates basic recommendations based on patient routine data. We have proposed decision support service called "Smart CDSS" that provides recommendations on PHR data for diabetic patients. Smart CDSS follows HL7 vMR (Virtual Medical Record) to help in integration with diverse application including PHR. PHR shares patient data with Smart CDSS through standard interfaces that pass through Adaptability Engine (AE). AE transforms the PHR CCR/CCD (Continuity of Care Record/Document) into standard HL7 vMR format. Smart CDSS produces recommendation on PHR datasets based on diabetic knowledge base represented in shareable HL7 Arden Syntax format. The Smart CDSS service is deployed on public cloud over MS Azure environment and PHR is maintaining on private cloud. The system has been evaluated for recommendation for 100 diabetic patients from Saint's Mary Hospital. The recommendations were compared with physicians' guidelines which complement the self-management of the patient.

1. Introduction

With the advance of technology and realization of information to be available anywhere and anytime, healthcare systems are emerged to share patient data within and across the boundary of healthcare facilities. To be most sophisticated, it has been revealed to provide patient centric personalized healthcare facilities at point of care and home care environment. PHR (Personal Health Record) is playing pivotal role to hand over control to the patients for managing their personal health information. There is substantial evidence that PHR provides patient centric facilities which enhance healthcare quality, and provide health benefits to patients [1]. PHR also help in self-management of patients' health having chronic disease like diabetes [2].

Institute of Medicine (IOM) has identified five key attributes that each PHR should contribute; PHR should be life long and comprehensive, it must be accessible from everywhere and in any time, provide help to patient in managing health and produce recommendations via easy to use tools, patient data should be private and secure and

patient has control on PHR to allow modifications [3]. In integrated environment of PHR with EHR (Electronic Health Record), the PHR capability should also provide some statistical and decision support services to summarize voluminous PHR data into EHR record [4].

In this paper we have proposed clinical decision support service namely "Smart CDSS". Smart CDSS service provides standard interfaces to integrate PHR with clinical decision support for chronic diseases such as diabetes. The integration provides PHR with integrated clinical decision support to help diabetic patient in managing their activities during self-management plan of cholesterol, blood pressure and glucose level.

Smart CDSS provides extension to allow integration of PHR data for decision support. Existing Smart CDSS application has already been tested for diabetic patients from EMR (Electronic Medical Record) of Saint's Mary Hospital. The system is provided with PHR Adapter that takes CCR (Continuity of Care Record) or HL7 CCD (Continuity of Care Document) to provide recommendation to integrated PHR service.

2. Proposed System Architecture

The proposed system comprise of three main modules as shown in Fig. 1; Adaptability Engine (AE), Interface Engine (IE) and Knowledge Inference Engine (KIE).

Adaptability Engine (AE) play vital role in integrating clinical decision support services to divers applications such sensor based applications, clinical information systems, EHRs and PHRs. In case of PHR, Adapter PHR converts the PHR data from CCR or CCD standard format to standard HL7 vMR (Virtual Medical Record) format. The recommendations based on PHR input data is converted back into appropriate CCR or CCD format and return to PHR system.

Interface Engine (IE) defines standard interfaces for clinical decision support in order to provide interoperable service to heterogeneous systems. The standard inputs and outputs follows HL7 vMR standard format and define contracts of cloud base web service through XML schema.

Knowledge Inference Engine (KIE) represents basic guidelines in HL7 Arden Syntax in form individual medical logic module (MLM). Existing knowledge base provide guidelines for diabetes derived from online diabetic resources. Knowledge reasoner allows reasoning on triggering appropriate MLMs for generating recommendations.

The PHR system resides on private cloud infrastructure to provide secure access to patient private data. Smart CDSS is deployed on public cloud, Microsoft Azure that support decision support of diabetes.

Communication between the PHR and Smart CDSS on public cloud has been secured via SSL. In order to provide privacy to patient data, anonymization service is deployed to anonymize patient demographic and other sensitive data not needed in decision support.

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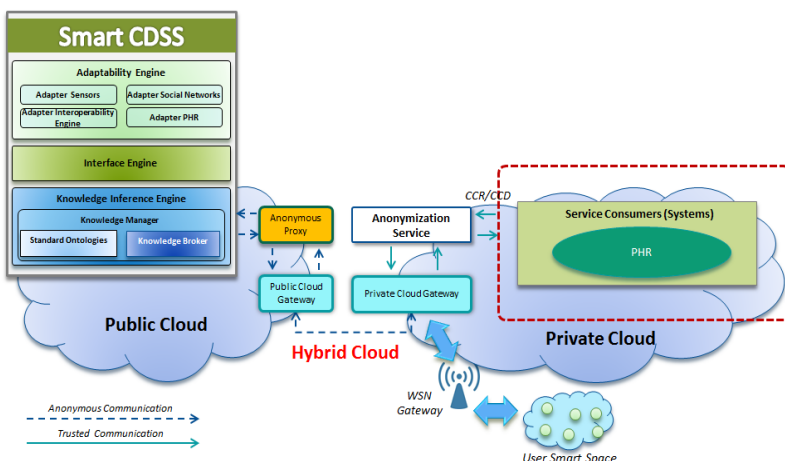


Figure 1: Proposed System Architecture