High-Level Query Language Support for EHRs Databases - Multi-step QBE Approach

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Abstract

Large scale adoption of electronic healthcare applications requires semantic interoperability. The new proposals propose an advanced (multi-level) DBMS architecture for common repository services for health records of patients. These also require query interfaces at multiple levels and at the level of semi-skilled users. In this regard, a high level user interface for querying the new form of Electronic Health Records (EHRs) has been examined in this study. Its aim is to decrease user effort and communication ambiguities, and increase user friendliness.

Keywords:

Electronic health records (EHRs), Archetype-based EHRs, Query language support.

Introduction

The EHRs have a complex structure that may include data of about 100-200 parameters, such as temperature, blood-pressure and body mass index. Individual parameters have their own contents. The openEHR (www.openehr.org) separates its contents from structure through its dual level model approach, consisting of reference model and archetype model. The openEHR architecture is similar to DBMS architecture [1]. To query upon EHRs, it proposes Archetype Query Language (AQL)[1], which is confined to system programmers' level.

Methodology

Multi-step QBE interface is a graphical user interface, proposed for meeting the querying need for the archetype-based EHRs. In spite of learning the complex AQL syntax, the semi-skilled user can use this approach. It takes into account the EHR structure [Figure 1] and parameter (archetype) structure. It involves two steps: 1) Determine the node/s involved in the query from EHR structure tree. (e.g., see BMI in example1). For the selected node, a graphical QBE interface will be depicted. User can compose algebraic query expressions using the appropriate variables (operands) in condition box. User can put a ".P" command in appropriate column(s) to specify the fields that should be shown in result.

[1]http://www.openehr.org/wiki/display/spec/Archetype+Query+Language+(AQL)+(Ocean) (Archetype Query Language).

Results

Example 1. Get the body mass index (BMI) values which are more than 30 kg/meter-square for a specific patient. Multi-step QBE approach:
Step 1: User selects EHR → Composition → Entry → BMI In step 1, the proposed multi-step QBE system presents EHR structure [Figure 1]. The EHR is populated by repository of archetypes. The user selects "BMI".

EHR	COMPOSITION	ENTRY
	Health encounter Referral Medication List Problem List Prescription	Blood Pressure BMI Temperature Heart Rate Lab test result Pregnancy Test Adverse Reaction

Figure 1-Graphical interface for EHR in Multi-step QBE

In step 2, based on the stored archetype structure in XML (or ADL); a QBE interface for BMI is presented to the user. At user's level, query conditions and results are expressed using conventional QBE notations (Figure 2).

Table Name	Data	Event	Protocol	
Body Mass Index	BMI	Time recording of BMI	Formula	Method
	.P >30			

Figure 2-Query Interface for BMI data

Conclusion

For the proposed EHR system, improvements in methods to access complex data have become essential. The new standard model proposed by openEHR requires that the EHR will be accessed by skilled and semi-skilled users. This requires better interfaces for access to data for hospital users and researchers. A query language to meet the new requirements has been proposed in this paper. The AQL is considered to be quite complicated for end-users to use, thus a visual-based alternative in the form of QBE. Multi-step QBE approach can simplify query formulation, as shown with the help of sample query.

References

[1] Sachdeva S., Bhalla S. “Semantic Interoperability in healthcare information for EHR databases”, DNIS workshop, Japan, Mar,2010.