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Life Line Management System for Medical Records

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Abstract

We present in this paper a new approach to share medical information in community health networks. We propose a graphical user interface management system based on a chronological representation of medical information called Life Line. The Life Line is useful to access all medical documents represented on a temporal axis; documents can be locally created or removed from external information systems. The Life Line Management System can be adapted on any legacy systems; can push local medical data towards other information systems and the opposite.

Keywords:

user computer interface, community health network, temporal axis

Introduction

Regional health networks have been proposed last ten years. These networks gather and share medical information about patients from different care places, essentially hospitals. The most frequent architecture of such networks is based on a pointer management system that stores in a server the addresses of each medical treatment. About medical data, they are stored in the legacy systems.

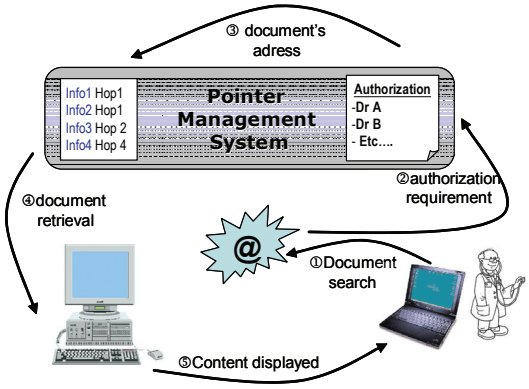

Figure 1- Network architecture

Such architecture is today very interesting to ensure data sharing in order to improve continuity of care. It will be used by the future French personal medical record called DMP.

The Life Line management system is complementary to this architecture in improving communication between general practice and hospital. It allows sending automatically data addresses to a platform called Life Line platform. It is quite similar to a semantic middleware between legacy information systems. The Life Line Management System is designed as a chronological axis on which a representation of medical documents is displayed. Such an ergonomic interface improves greatly information research and gives a synoptic view of the medical record.

The following paragraph describes the Life Line Management System according to different aspects (description, architecture, data transfer). A short paragraph concerning the related works is presented just before a conclusion.

Life Line Management System

Presentation

The Life Line Management System is both a data representation system (object types design), a graphical user interface to display data and a data exchange platform (to retrieve, display and send data).

The data representation system defines an iconic structuring (at interface level) for each parts of document (called objects) whatever their data source format in legacy systems.

The graphical interface is based on a chronological representation of the medical record on which every document (broad sense) is displayed wherever it has been created.

The data exchange platform is used to extract objects from a server, to display them on a local system and at the opposite, to send them from a local system to another legacy system. These information systems can be hospital IS or GP IS.

The Life Line Management System is associated to the Rhône-Alpes Regional Health Platform (SISRA) [1] to help the connection between GPs information systems and hospitals to share information about patients. Rhône-Alpes is the second largest administrative region in France after Ile-de-France (which includes Paris). As large as Denmark in size and with 6 million inhabitants, it is comparable to a European country. Rhône-Alpes has 300 healthcare facilities, three academic medical centers (based in the cities of

Lyon, Saint Etienne and Grenoble), one regional comprehensive cancer center, more than 20 000 physicians and over ten thousand caregivers. The concept of a universal electronic patient record (DPPR) was initiated in 2000 by health professionals from the regional comprehensive cancer center of Lyon (Centre Léon Bérard) and the ONCORA community cancer network (ONCOlogy Rhône-Alpes).

Iconic structuring

Object definition

The iconic structuring has two conceptual parts: a definition of objects according to criteria and a screen representation as icons.

The criteria chosen are: composition, communication and abstraction.

- Composition criterion: objects are classified into simple and complex object.
  - A simple object has only one type which is: text, image, number, etc.
  - A complex object is composed of simple objects and/or complex objects. As an example, an X ray is a complex object composed of two simple object (image) and a summary (text).
- Communication criterion: objects are classified according to their sharing possibilities. We define specialty objects, private objects and communicating objects.
  - A specialty object is only readable by his creator and by doctors with the same specialty (a chemotherapy guideline can be seen by the "owner" of the object and by all the oncologists that may care the patient) but not by specialists of another domain.
  - A private object is protected at the local level and never sent throughout the network. As an example, a sport medicine object is private and so not shared.
  - A communicating object is seen by all medical partners.
- Abstraction criterion: objects have a basic structure defined by experts of the medical domain. The instantiation of abstract objects produces concrete objects. This structure encapsulates an identifier, a name, a type and a iconic representation.

Object types		
Composition criterion	*Abstraction criterion*	*Communication Criterion*
Simple object	Simple abstract object	Specialty simple abstract object
		Communicating simple abstract object
		Private simple abstract object
	Simple concrete object	Specialty simple concrete object
		Communicating simple concrete object
		Private simple concrete object
Complex object	Complex abstract object	Do not exist
		Do not exist
		Do not exist
	Complex concrete object	Specialty complex concrete object
		Private complex concrete object
		Communicating complex concrete object

Figure 2 - Object types classification

Iconic interface representation

The second part of the Life Line Management System is a graphical user interface useful to identify the different objects according to shapes and colors.

Figure 3 shows the interface with icons and the chronological representation of the medical record.

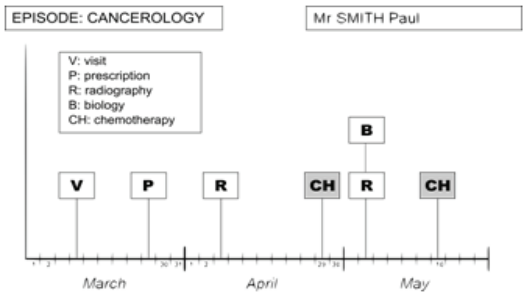

Figure 3- Graphical interface

The graphical interface has been made with different levels of granularity. A synthetic view displays all diseases on the axis and a focus on a particular episode (here Cancer) displays the objects useful to follow up the disease. In the example, the icon **CH** is a specialty object; the others are communicating objects. The difference between abstract and concrete objects is not obvious on this screen: the content of each icon is a concrete object because a click on each icon gives the content of the document. For example, a click on **R** shows the result of the X ray. The structure of

each icon corresponds to an abstract object and its content to a concrete object.

Architecture

The Life Line Management System is represented by a Life Line platform that directly connects GPs information systems to hospitals information systems (fig.4). Every server (hospital or GP) can push data on the Life Line platform and share medical information about patient. As a consequence, on a local user information system, data are displayed wherever they are created and stored.

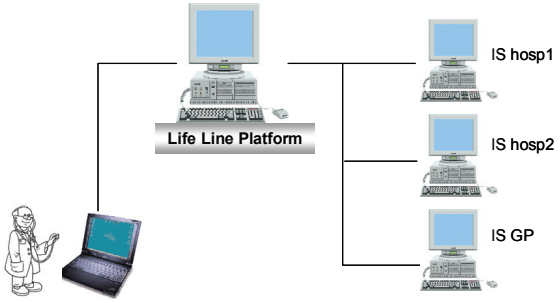

Figure4- Global architecture

A list of shared objects is sent to the platform that enhances the list of objects addresses. A click on a shared object on the Life Line interface opens directly the content of the object: in fact, the object address is automatically opened and its content displayed on the screen. When an object is not readable by a given doctor, this object does not appear on the Life Line.

Transfer of data on the network

For each object, a URL is defined. This address is automatically sent to the Life Line platform and added to the addresses list. A remote or local object is added to the patient's medical record and its content displayed as required. Fig. 5 shows how the data transfer can be done. A user request (simulated by a click on the object) send a query to the different servers and when the server which stored the object is found, an extraction is made and the content is displayed on the user's screen.

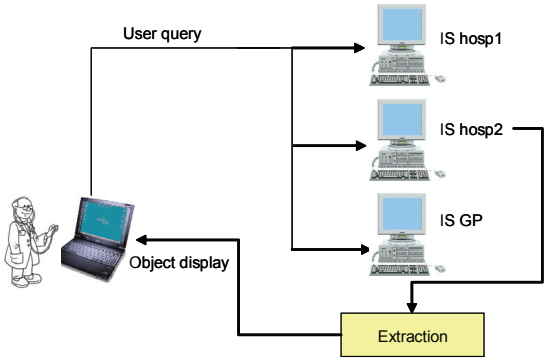

Figure 5- Extraction process

Interface

The interface is separated out in 3 parts: the first part is dedicated to the objects knowledge base. The second part is a part of abstract objects instantiation. The third part represents the chronological axis with objects (fig. 6).

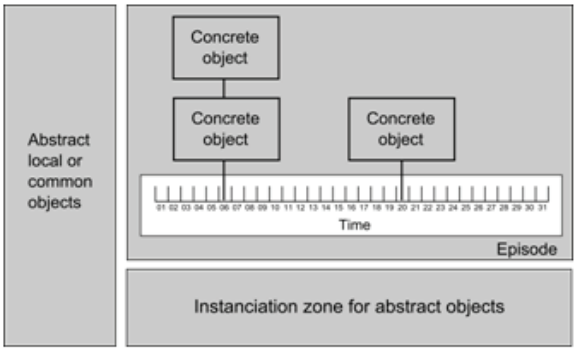

Figure 6- General architecture of the interface

The different following screens show different ways for displaying and sharing objects.

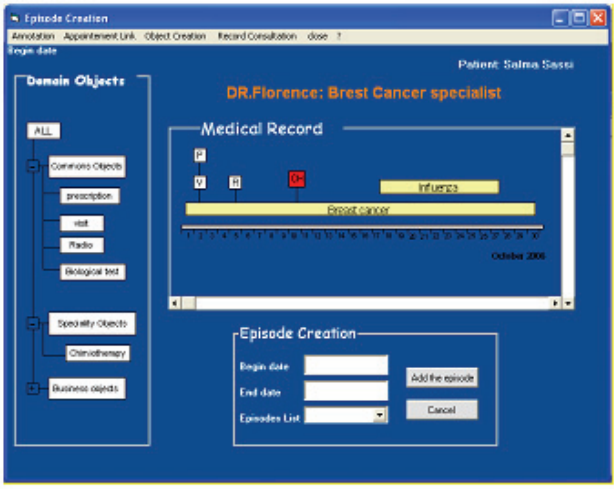

Figure 7- Concrete object instantiation

In this screen, the user creates his concrete objects concerning a disease episode. Objects are retrieved from the knowledge base and episode from a disease classification or ontology.

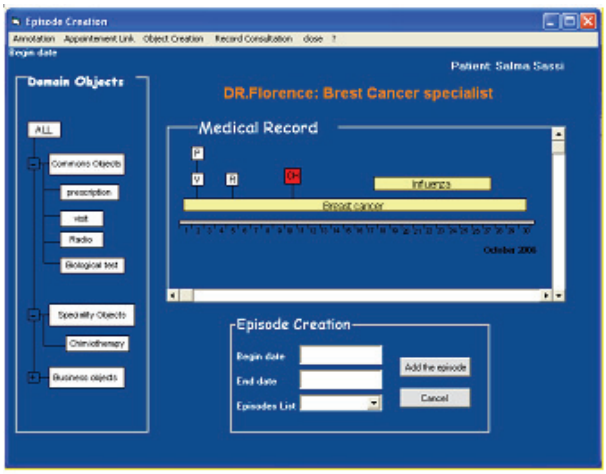

Figure 8- Interface for a specialist

In this screen, chemotherapy is a specialty object which is locally created by the oncologist. This object will be only shared by same specialists.

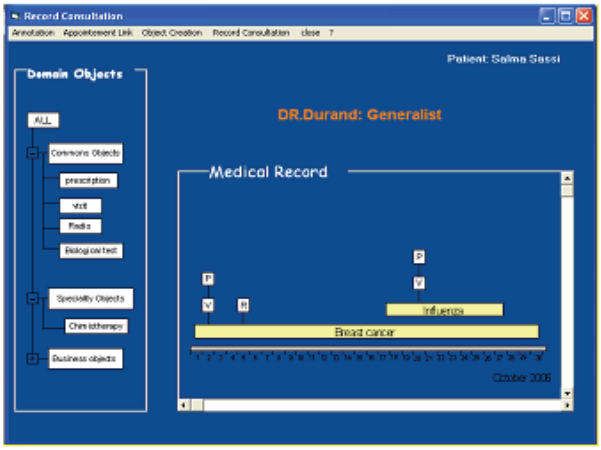

Figure 9- Interface for a GP or another specialist

In this screen, are only displayed the objects shared by everybody in the health networks.

Related works

Many groups are currently investigating medical platforms using different approaches: the first approach consists of considering the web as a useful medium to link medical data and facilitate patient follow-up. In [2], the authors describe the automation of processes between ambulance services and emergency units. The system is based on web services and workflow systems. Another interesting work addresses the transfer of information within a hospital: documents created in various formats and stored in different subsystems are made available to authorized persons for the follow-up of cardiac patients [3].

Other systems have been developed in telemedicine using standard tools. For example: Telemed [4] uses Corba [5] to connect multiple health information systems.

Other works have addressed the issue of interoperability between heterogeneous medical information systems. [6] and [7] have created Pilot, an application program interface that serves as a mediator between different information systems. [8] have proposed an upstream system which creates an exchange format at the conceptual level (use cases). Semantic integration is also a very important topic of research, with interesting studies published by [9], [10], [11].

Some approaches are more centered around the users and propose navigation tools: the project by Ouziri et al. [12] displays medical data using a concept configuration which represents a secured and semantically correct information space. This approach is based on Topic Maps and Description Logics. Users build their own data interface. Another interesting work concerns the integration of interfaces [13]. Finally, some studies have been carried out to promote evaluation in health networks [14] and [15].

Conclusion

To share medical data between heterogeneous information systems is not easy. Some platforms exist to help for data communication. We have proposed in this paper a new architecture with three different aims: a interface structure for objects, an exchange platform and a chronological representation of the medical record. This system can be used as a middleware between legacy information systems.

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