E-HEALTH SERVICES IN HL7 STANDARD

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Abstract: Health care is the diagnosis, treatment, and prevention of disease, illness, injury, and other physical and mental impairments in humans. Health care is delivered by practitioners in medicine, chiropractic, dentistry, nursing, pharmacy, allied health, and other care providers. E-Health tools allow the construction of patient-centric Healthcare Service Providers that aim to support patients to access health related information, to prevent their possible diseases and to monitor their health status. The system builds a profile for each patient and uses it to detect Healthcare Service Providers delivering E-Health services potentially capable of satisfying the patient needs. The proposed system is HL7-aware represents both patient and service information according to the directives of HL7, the information management standard adopted in medical context. Once patients submit a query the proposed system retrieves a set of relevant services which satisfy the need of the patient. However E-Health is evolving into entities such as mobile health which focus on providing healthcare to people anywhere, anytime using broadband and wireless mobile technologies.

Keywords: HL7 - AB - HeCaSe – MMA-E-Health.

I. INTRODUCTION

This paper support patients in search of healthcare services in an E-Health scenario. To adapt the technologies to new scenario, a service-oriented approach is gaining popularity. In this context, services are software entities that can be described, published, discovered, orchestrated, and invoked by other software entities. A service-oriented approach to E-Health must consider semantic, because in healthcare, every description must have a unique, clear meaning. So, defining and maintaining expressive ontology for E-Health are crucial. Healthcare applications are usually based on interactions between people playing different roles in diverse organizational contexts.

The system builds a profile for each patient and uses it to detect Healthcare Service Providers delivering E-Health services potentially capable of satisfying needs. The proposed system is HL7-aware represents both patient and service information according to the directives of HL7, the information management standard adopted in medical context. In order to handle this search it can exploit the algorithm called AB, relies on A*-Based, a popular search algorithm in Artificial Intelligence. Once a patient submits a query and retrieves a set of services relevant to them and they benefit from these services. And also the patient can use the mobile health which focuses on providing healthcare to people anywhere at any time. Most industrialized countries are shifting toward a knowledge-based economy in which knowledge and technology play a key role to support both productivity and economic growth. The application of Information and Communication Technologies on the whole range of health sector activities (also known as E-Health) can simplify the access to healthcare services and can boost both their quality and their effectiveness. Despite the abundance of available proposals, the retrieval of interesting services is not always easy.

In addition, the vocabulary used by a patient for composing his queries is often limited and consists of quite generic terms; on the contrary, medical resources and services are often described by means of specialized terms. As a consequence, patient queries usually fail to match with documents describing medical resources and services. HL7 has been conceived:
1. To support information exchange among systems characterized by heterogeneous technologies.
2. To allow each local organization to perform some variations yet maintaining a high level of standardization.
3. To allow a gradual evolution in such a way as to adapt itself to variations in the healthcare context and to cover each aspect of the healthcare scenario.
4. To operate without assuming any specific architecture for the underlying information systems and
5. To comply with the other standards defined in the healthcare context.

The combination of the designed medical ontology with the multi-agent system provides a flexible framework to follow the execution of clinical
guidelines. In that process, two main tasks are required:
a) to know the source of a data contained in an enquiry, and
b) to identify the actor that provides an action and its result.

II. RELATED WORK

“HeCaSe: An Agent-Based System to Provide Personalised Medical Services” [9] is a multiagent system that handle personalized medical services. A significant extension of this system is to help doctors to collect and manage information about patient and coordinate complex tasks. The proposed one and this share some similarities that is both of them exploit rich user profiles and dynamically update them to better and timely defining user preferences. The main differences between the two are the social network that the paper provides. It provide the interaction between doctor and patients and devoted specifically to patients whereas Hecase2 handle various type of users [4].

“Towards Patient-Related Information Needs,” follows the approach to support physicians to retrieve medical information. It uses additional knowledge to support the retrieval of medical information. The main focus of this system is to manage information retrieval tasks. The physicians to search documents about patient care. Current paper differs from this in many ways it is designed to support query management. It also uses additional knowledge to support the retrieval of medical information [8].

“Adaptive Medical Information Delivery Combining User, Task and Situation Models,” the Mars Medical Assistant (MMA) system is proposed. The user profile is based on stereotypes and takes a great care to the graphical interface characteristics desired by a user. It handles various types of users [9].

“Leveraging a Common Representation for Personalized Search and Summarization in a Medical Digital Library” PErsionalized Retrieval and Summarization over Images, Video And Language (PERSIVAL), conceived to support .This system and the current system are similar in that, both of them use keywords for representing patient and service profiles and in both of them retrieval activity is driven by patient profiles. The main differences between them are the end users. In PERSIVAL the physicians whereas the end users of paper are patients and that is provided with a summarization functionality, which is not present in the paper [10].

III. PROPOSED SYSTEM

The proposed system is HL7-aware in that it represents both service and the patient information. HL7 provides several functionalities for the exchange, the integration and management of data regarding both patients and healthcare services. It is a widely accepted standard. In general the vocabulary used by a patient for composing queries is often limited and consists of quite generic terms on the contrary medical services are often described of the specialised terms. As a result the query usually fail to match; In order to avoid this system provides the facility to provide the search in common terms.

The system provides the ontological search in which the required answer will be retrieved easily. The match for the query is done efficiently and the result is displayed. For processing the query the following parameters are taken into account.

Goodness: which is denoted by $G_{ij}$, measures the “aptitude” of a HCSP Database $SD_j$ to answer query $Q_i$. $G_{ij}$ depends on the number of services stored in $SD_j$ capable of satisfying $Q_i$. The formula for the computation of $G_{ij}$ is

$$G_{ij} = \frac{|U_{Q_i \in QKS_i}^{\text{SSet}_{ij}}|}{\text{card}(SD_j)}$$

where $QKS_i$ is the set of keywords associated with $Q_i$, $\text{SSet}_{ij}$ represents the set of services associated with $SD_j$ containing $Q_i$ in their set of keywords, and $\text{card}(SD_j)$ denotes the total number of services stored in $SD_j$.

Affinity: denoted by $A_{ij}$; it quantifies the correlation degree existing between $PP_i$ and $SD_j$. It is computed by considering that the larger the number of services stored in $SD_j$ containing at least one keyword stored in $PP_i$ is, the higher the correlation.
between PP\textsubscript{i} and SD\textsubscript{j} will be. The formula for the computation of A\textsubscript{ij} is

\[ A_{ij} = \frac{\bigcup_{k} e_{MP_{i}} S_{Set_{ij}}^{s}}{\text{card}(SD_{j})} \]

where MP\textsubscript{i} is the Medical Profile of Pi whereas SSet\textsubscript{ij} represents the set of services stored in SD\textsubscript{j} containing Ksi in their set of features.

**Source Similarity:** denoted by \( S_{lm} \) it receives two HCSP Databases SD\textsubscript{i} and SD\textsubscript{m} and measures their similarity degree. In order to compute \( S_{lm} \), it is necessary to specify how the similarity between two services can be computed. Specifically, let S\textsubscript{pl} and S\textsubscript{qm} be two services stored in SD\textsubscript{i} and SD\textsubscript{m} respectively. The similarity between them can be computed by applying the Jaccard coefficient as

\[ \sigma(S_{i}^{p}, S_{m}^{q}) = \frac{|SFS_{i}^{p} \cap SFS_{m}^{q}|}{|SFS_{i}^{p} \cup SFS_{m}^{q}|} \]

where SFS\textsubscript{pl} (resp., SFS\textsubscript{qm}) is the set of features associated with S\textsubscript{pl} (resp., S\textsubscript{qm}). Now, S\textsubscript{lm} can be computed as

\[ S_{lm} = \frac{\sum_{e_{SD_{i}}} \sum_{e_{SD_{i}}} \sigma(S_{i}^{p}, S_{m}^{q})}{\text{card}(SD_{i}).\text{card}(SD_{m})} \]

The value of goodness, Affinity and source similarity ranges between the interval [0,1].

### IV. PROTOTYPE

The prototype was realized in Spring Framework 2.0, a compliant platform for developing the application. The main reasons for choosing the spring framework is as follows: 1) complete support for all the modern application, 2) spring framework is asynchronous, message based and provide security.

Patient can interact with the system by means of suitable graphical interfaces. The interaction protocol consists of the following steps:

- A patient logs into our system by specifying the username and the password provided during the registration.
- The system provide the patient with the graphical interface as shown in the fig.1, to help him submitting the query. After he submitted the query the result is displayed. The search is provided with options as normal and advanced search.

![Fig 1: Shows the services](http://www.ijcttjournal.org)

- The normal search is provided for novice users. The search is done by common terms. The advanced search is for the user who are familiar in technical terms. The patient can view the report. The schedule of the doctor and patient is done by the Healthcare Service Provider.
- The fig 2 shows the patient page. In that the patient are provided with information of their appointment and report. In the end of the page they are provided with chat form. The patient can fill the details and can do chat.

![Fig 2: The report of the patient](http://www.ijcttjournal.org)
• The patient can also do search and view report with mobile phones by specifying corresponding username and password.
• The Healthcare service Provider can view the registered patient details, upload query, allot schedule for patient and doctor.

Fig 3: Patient access services through mobile

• The doctor have to register themselves in the site by providing the certificate ID. Doctor can view the schedule and can interact with the patient at particular time with the unique ID.

V. RESULTS

This paper aims to support a user in his access to healthcare Services. In Hecase2 a system supporting a user to retrieve relevant information in a medical context is proposed. It is possible to detect some similarities between our system and that system. Specifically, both of them provide a suitable formalism to represent medical resources and provide a technique to determine the importance of each keyword composing a query.

As for the main differences between them we observe that our system has been conceived to support mainly patients, and on the contrary, the approach of Hecase2 aims to support a wider range of users (e.g., patients, health professionals, etc) and the system of Hecase2 does not take patient profiles into account.

In Agent based retrieval a multiagent system aiming to support physicians to retrieve medical information is described. As for the main similarities between that system and ours, we observe that both of them are provided with a suitable data structure for modelling patient needs. And that system has been conceived to support mainly physicians, and requires a medical ontology whereas our system exploits both patient and service profiles.

VI. CONCLUSION

In this paper the HL7 standard system that supports patients in their access to services delivered by Healthcare Service Provider is delivered. The proposed system intelligently identifies the patient needs and provides the services. And providing a service to the patient has been improved. This is achieved by the mobile access of the services by the patient. This system has the facility of feedback so that patient can give their suggestion about the services that was provided.

As for now the paper is concentrating only on diabetes and its type. In future this can be developed to include details of variety of diseases. From the feedback which gets from the user the enhancement can be made. In its turn the feedback could be taken into account in the selection of services answering user query.

VII. REFERENCES