Towards a Personalizable Health System for Diabetes

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Abstract— **This paper introduces several extensions to the architecture of current state-of-the-art personal health systems, that aim at improving their adaptability to the user needs, their scalability, and their interoperability. These extensions are/will be applied to a real system for monitoring gestational diabetes.**

I. Introduction

Pervasive healthcare is the *healthcare to anyone, anytime and anywhere* [1]. One of its main goals is to define Personal Health Systems (PHS) to shift the paradigm of healthcare services, by moving them from a centralized approach focused on doctors to a decentralized one based on the patients. This new approach is expected to reduce the long-term costs of healthcare services.

PHSs usually have a 3-tier architecture [2]. Tier 1 is the Body Area Network (BAN) in which sensors are deployed on the body of the patient. Tier 2 is a gateway to bridge sensors data with a remote base station, where the gateway can be a tablet, a mobile phone or a portable device. Tier 3 is the remote monitoring system and it is in charge of storing and analyzing data for providing assistance to the patients and helping doctors on the management of their patients at the same time.

The goal of the work described in this paper is to give a new approach to the current state-of-the-art applications in that field. We focus on the scalability to provide good health services to a huge number of people, and the interoperability to develop a collaborative system. Furthermore, the system is personalizable in the sense that doctors can adapt rules based on medical guidelines according to the needs of their patients.

II. Our Approach

We propose a PHS for the management of gestational diabetes mellitus (GDM) to achieve the goals explained before.

The main difference between our approach and the state-of-the-art is that we will move the computations done to health data from tier 3 to tier 2. Tier 3 is a common part of the system for all the users and therefore it represents a bottleneck for the system. Therefore, moving most of the computation to tier 2 will have a positive impact on the scalability of the system. In our system this measure involves the deployment of an intelligent agent [3] into an Android based smartphone which acts as a gateway in tier 2. Our intelligent agents reason about data gathered from tier 1 according to a set of logic-based rules built around guidelines for GDM, and provide alerts when a situation of interest for the patient is detected. For example, our system may report to medical doctors frequent hypoglycemias, frequent hyperglycemias or abnormal blood pressure readings.

Furthermore, most of the current systems do not address interoperability and thus are not able to work in a federated manner. To deal with interoperability we propose the use of RuleML [4] in conjunction with the HL7 [5] standard. RuleML is a *de facto* standard for knowledge representation and can be used to express medical guidelines that can be sent from tier 3 to tier 2 and loaded into the agent at runtime. On the other hand, when an alert is triggered all health information related with it can be sent from tier 2 to tier 3 using HL7.

Finally, RuleML allows us to reconfigure our PHS by changing the behaviour of the agents. Doctors often want to personalize medical guidelines to each of their patients. In our PHS approach, doctors will be allowed to modify the RuleML based medical guidelines that must be sent to the intelligent agent that is monitoring a particular patient, by using a graphical user interface provided by a web application. This aspect is challenging as there is a tradeoff between expressive power and complexity of usage

III. Conclusions

In this paper we have presented our proposal for the architecture of a PHS that is adaptive, scalable and interoperable. The expected benefits of the measures proposed are: to support a bigger number of patients without reducing the performance of the system, an optimized use of network resources by reducing the communication between tiers 2 and 3, and finally to allow doctors to personalize the behavior of the PHS according to the patient's needs.

References

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