A Mobile Agent-Based Technique for Medical Monitoring (Supports of Patients with Diabetes)

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ABSTRACT

Telemedicine is a particularly useful means to optimize the quality of care by fast medical exchanges that benefit patients whose state of health requires an appropriate and fast response, regardless of their geographic location. In this paper, the authors propose a mobile agent based architecture (DiabMAS) for remote medical monitoring of diabetic patients on an outpatient basis using mobile devices (laptops, PDAs, etc...) by exploring the new operating Mobile system, Android. DiabMAS is a multi-agent system having as main objective the improvement of the transmission of information between patients and their physicians, especially the management of specific and critical cases.

Keywords: Android, Diabetes Multi Agent System (DiabMAS), Medical Telemonitoring, Mobile Agent, Multi-Agent System

INTRODUCTION

Health monitoring, knowledge sharing and optimized management of healthcare costs, technological innovations adapted to provide medical services have added value to traditional health care system. They promote increased quality of medical expertise while ensuring the satisfaction of medical staff and patients.

The “mobile agent” technology is more attractive given the benefits it provides for the achievement of complex and repetitive tasks in open and dynamic systems. This approach has a strong interest in the implementation of applications whose performance varies depending on availability.

A mobile agent is a software entity that moves from one site to another running to access data or remote resources. It moves with its code, execution state and its own data. The migration decision can be initiated by the agent itself, autonomously, and mobility is controlled by the application and not by the runtime system. The purpose of the trip is usually to access data locally or in remote resources initially, to perform the local processing and not to move the data. The purpose of using an agent is to reduce the traffic, thus sending the agent where the tasks are done, the exchanged messages become local and therefore reduce network load (Seghrouchni & Briot, 2009; Briot & Demazeau, 2001).

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Our work goes in this direction. We study the use of mobile agent technology and multi-agent systems (MAS) (Briot & Demazeau, 2001) in the field of health. The DiabMAS (Diabetes Multi Agent System) represents medical monitoring that is conducted using mobile devices, namely Android.

Indeed, the main goals of our system can be summarized in four points:

- Monitoring diabetic patients and ensuring the continuity of care.
- Reducing costs by reducing the movement of patients and professionals.
- Specific management of specific and critical cases that could arise.
- And thereby, improving service delivery and patient satisfaction.

BACKGROUND

Diabetes in the World

The number of people with diabetes is increasing due to population growth, aging, urbanization, and increasing prevalence of obesity and physical inactivity. Quantifying the prevalence of diabetes and the number of people affected by diabetes, now and in the future, is important to allow rational planning and allocation of resources.

The prevalence of diabetes for all age-groups worldwide was estimated to be 2.8% in 2000 and 5.4% in 2030. The total number of people with diabetes is projected to rise from 150 million in 2000 to 300 million in 2025 (Gan, Marlin, Piemonte, Riley, Roglic, & Unwin, 2008). See Figure 1.

Diabetes in Algeria

Like many other developing countries, Algeria is undergoing a transition in its disease profile. The emergence of non-communicable diseases, including obesity-driven diabetes, is forcing a shift in healthcare policy towards the prevention and effective management of chronic conditions. Algeria is a vast country, the largest in Africa.

The current population is around 35 million, about 70% of whom live in the northern, coastal region; the minorities who live in the Sahara are mainly concentrated in oases, while around 1.5 million are nomadic communities. Almost 30% of Algerians are under 15 years of age (Malek, 2008). These geographical and demographic characteristics reflect the organizational problems confronting healthcare planners and providers, particularly in terms of the chronic-disease risks faced by a young population that is getting younger.

What is Telemedicine?

Telemedicine (Lavoult, Traineau, & Culnaert, 2009) (Simon & Acker, 2008) generally refers to the use of information and communication technologies (ICT) for the delivery of clinical care (Figure 2).

Telemedicine is a confluence of Communication Technology, Information Technology, Biomedical Engineering and Medical Science (Figure 3) (Lavoult, Traineau, & Culnaert, 2009; Simon & Acker, 2008).

Major Areas of Telemedicine

The major types of telemedicine applications are (see Figure 4) (Lavoult, Traineau, & Culnaert, 2009):

METHODOLOGY

Multi-Agent System Approach in the Medical Field

In the medical field, multi-agent systems (Seghrrouchni & Briot, 2009; Ferber, 1995; Briot & Demazeau, 2001) can provide services that facilitate decision-making process for medical staff (Ganendran, Ganguly, Ray, & Low, 2002), providing a larger volume of information about certain situations and reducing the number of operations performed by the human operator.
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