Medical event notification system using SMS technology

To cite this article: J Voos *et al* 2013 *J. Phys.: Conf. Ser.* **477** 012015

View the article online for updates and enhancements.

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Abstract. This paper presents a medical event notification system implementation using short message service (SMS) over the cellular network. The main objective is the announcement for vaccination campaigns and availability of a particular medical attention at health sites where these services are not regularly provided. In this way, it provides a tool that facilitates healthcare in remote locations without medical assistance infrastructure. Since the main requirement of these systems is to achieve its massive adoption, SMS service is used to guarantee reaching all recipients regardless of their mobile device technology.

1. Introduction

Actually in our country there are remote areas that do not have good access to healthcare without health facilities and medical specialists in all disciplines. For this reason, public and private organizations use mobile assistance systems to provide medical care to these regions, including services such as vaccination, medical checkup and studies, prevention activities and medical specialist attention. Considering this need, we propose a medical event notification system based on SMS messaging service, in order to provide a communication channel that guarantees the announcement to all recipients of a health initiative.

1.1. Current situation

The use of information systems and communication technologies to support the achievement of health objectives (eHealth) is an area currently being developed worldwide, and has minimal initiatives in our country. The development of this kind of projects is a priority area in our country, as described in the publication libro blanco de la prospectiva TIC: proyecto 2020 [1], from the Ministry of Science, Technology and Productive Innovation of Argentina. In eHealth there are other more specific areas such mobile health or mHealth, defined as a health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants (PDAs), and other wireless devices.

The growth of mobile phone subscriptions and the new technologies into phones enable the use of these devices for health services. According to the second global survey on mHealth compiled by the World Health Organization (WHO) [2] in 2011 most of its member countries (83% of 120 countries) reported the existence of at least one health program using the cell phone network. This implies that a large number of countries are adopting mHealth initiatives to address health needs in different areas of application, as shown in Figure 1.
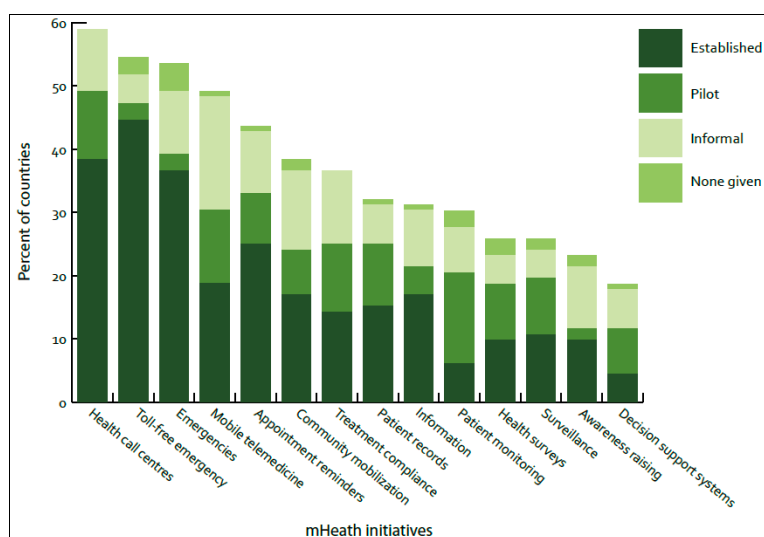
Figure 1. Adoption of mHealth initiatives and phases.

In Argentina there are telemedicine initiatives developed by private and public companies using cellphones, but require phones with special features like smartphones with internet connection to run. For this project, the SMS service was selected instead of an Internet connection using GPRS, due its wide coverage in our country and the possibility to receive/send messages from any cell phone. While the cost of GPRS service has declined considerably today in our country, the coverage provided for this service is still concentrated in big population cities reducing the geographic scope of mHealth initiatives, conditioning ultimately their social impact.

1.2. Proposal

Considering the potential of mobile technologies for telemedicine applications and prioritizing the massive adoption for low cost technologies, we propose the design and implementation of a medical event notification system based on SMS messaging service.

Additionally, the reduced data used on the SMS service messages enables delayed transmission according to the timeframe when the potential patient has signal; making efficient use of an irregular cellular network signals, a typical scenario for regions with low population density where these medical campaigns are implemented.

2. Development

2.1. Overview

The team involved in this initiative has experience on previous telemedicine projects including systems development and biomedical equipment for signals acquisition design; using the HL7 protocol and the cellular network as transmission channel [3] [4]. Following this telemedicine line of research, the existing platform will be upgraded developing new modules for sending SMS messages, as shown in Figure 2.
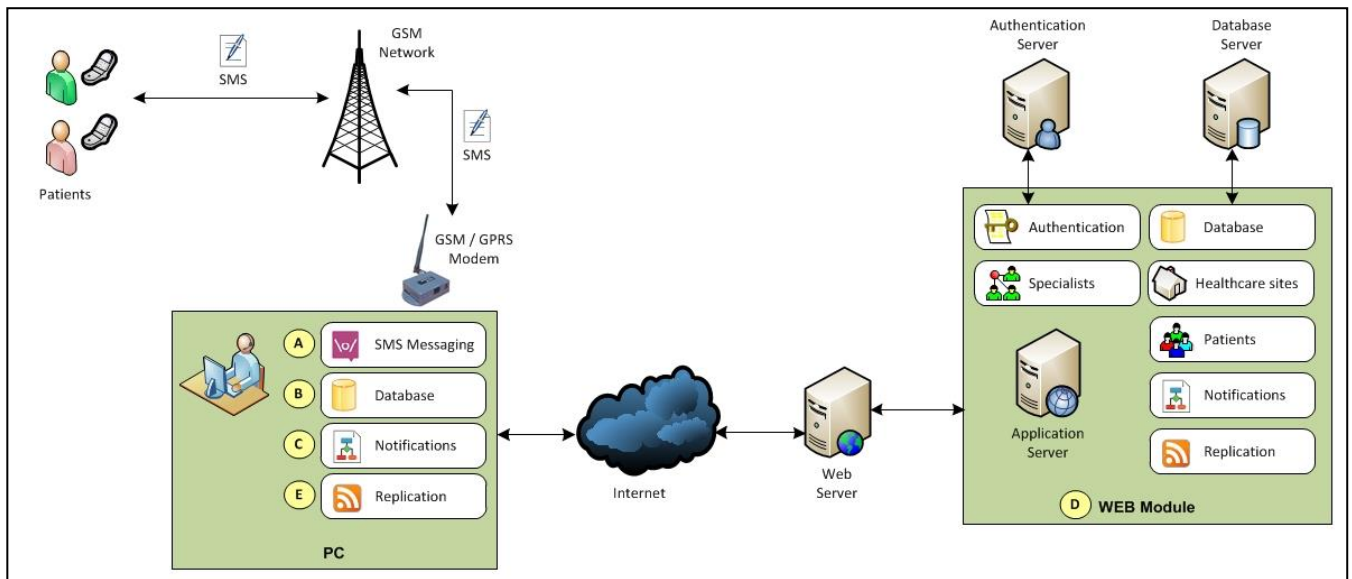
Figure 2. Notification system - Operational modules.

The project includes a software for send/receive SMS messages running on a PC with a modem (A) that allows it execution in remote sites without Internet connection. To select the recipients for a particular medical event, a database (B) is deployed to allow people selection according to different criteria (e.g. age group, sex, place of residence, illness, etc.) in response to the needs gathered in the place where the medical event will be made.

A web module is developed (D) for system access through Internet in order to let notifications management by specialists or other persons associated with a particular campaign, allowing also track responses to SMS messages sent, thanks to a replication software component (E) installed on the PC where the modem is installed.

Additionally, based on the settings per each notification, the system will send another SMS to the patient with the details of the assigned appointment time (C), in order to organize the medical attention and prevent having all the attendees going at the same time for a medical service.

2.2. Operational modules
Based on design showed in Figure 2, the system contains the following modules:

2.2.1. SMS messaging module. This module is implemented by one system running locally on a PC. After analyzing various open source solutions, FrontlineSMS messaging system [5] was selected due the integration facilities with other existing software components and the easy to use by end users without technical skills, as shown in Figure 3. The system was successfully implemented in other mHealth initiatives worldwide and has a support team ready to help based on their previous experiences on this kind of projects.
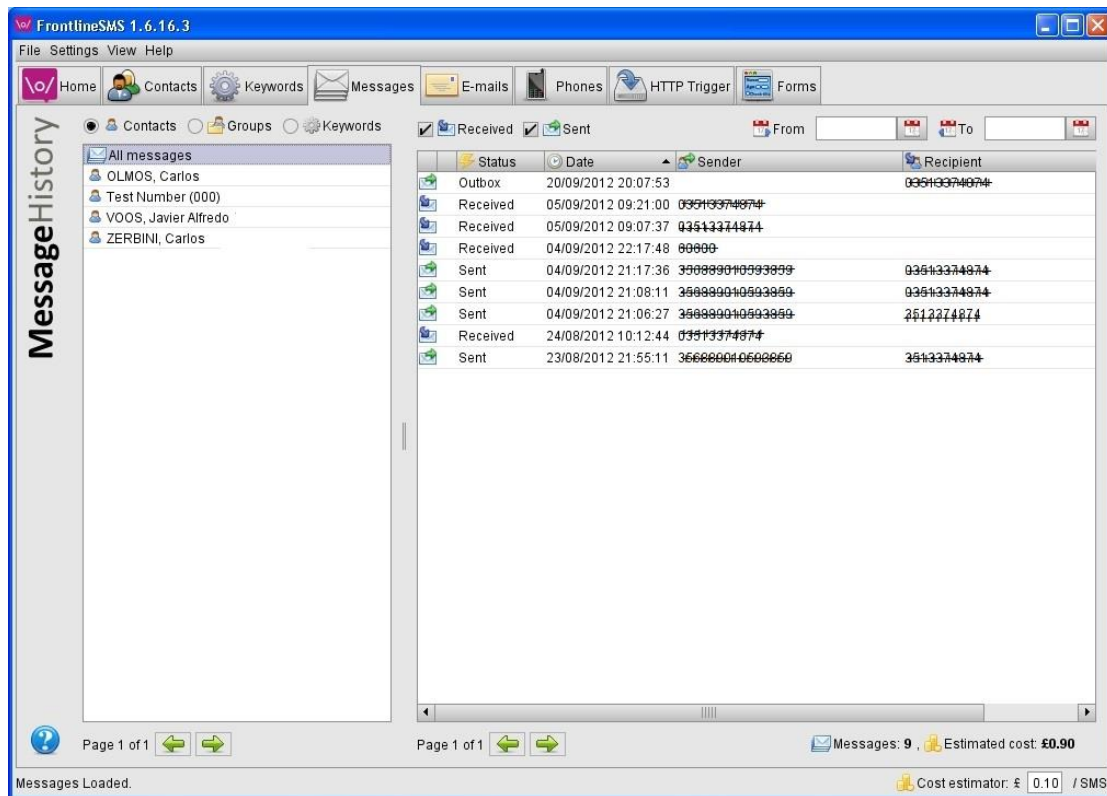
Figure 3. FrontlineSMS – SMS messages inbox.

2.2.2. Database module. To store patients and specialists information, healthcare sites and notification settings. It also contains the data related to messages and responses, in order to know in advance the patient participation for a particular campaign. The data model is described in Figure 4.
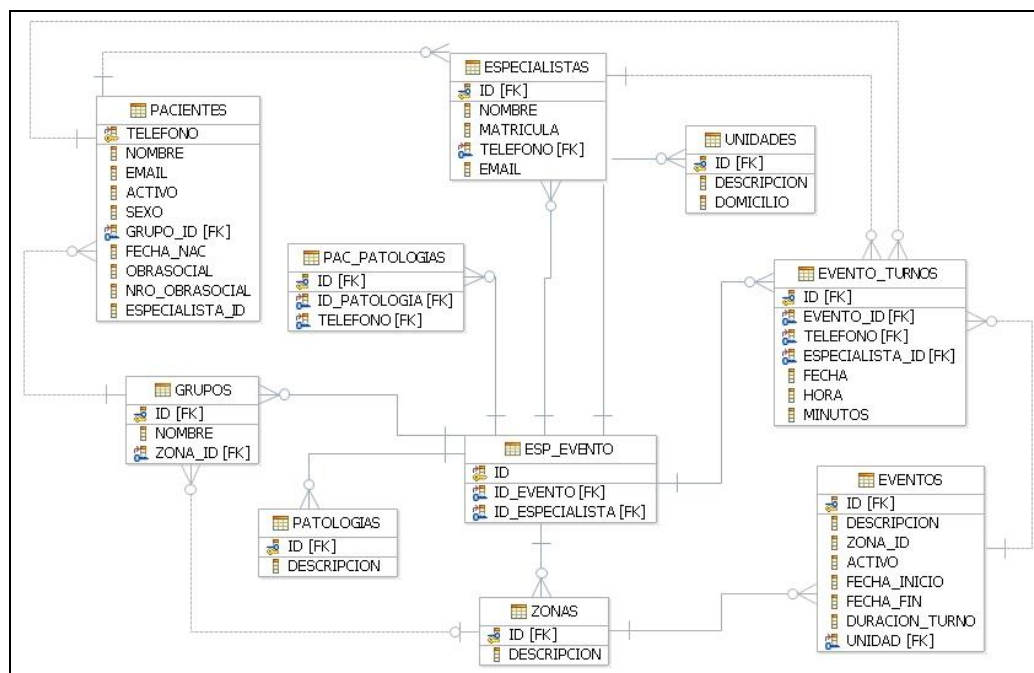
Figure 4. Notification system data model.

2.2.3. Notification management module. To provide the different notification settings related to the health initiative. Additionally, processes the responses sent to each notification and generate reports associated with the results for a particular campaign.

2.2.4. Web module. To offer a website for the database module maintenance, including new medical event creation to configure the appointment duration associated with this particular notification. Additionally it is feasible to visualize responses to the notifications sent and results for the health initiative.

2.2.5. Replication module. To replicate the information stored on the PC to the website and vice versa, in order to have the same information in both places.

3. Conclusion

This project aims to contribute the adoption and implementation of telemedicine projects, in particular mobile health provision, in our country. The main objective is applied low-cost services and execution feasibility in every place where a cell phone has enough signal to exchange SMS messages. This is especially suitable to our country social context: large geographical areas with low population density having sporadic and weak signal in remote areas. Currently we are working on this project implementation at public hospitals together with the Ministry of Health, a department for the Córdoba province government, Argentina.

There is a mature mobile phone technology and it is massively adopted by the population, reaching remote areas with low-cost services and high impact. The proposed system has the advantage of minimum hardware requirements, could be easy integrated with other existing telemedicine platform and the notification recipients can use any cell phone capable of receiving SMS messages for its execution.

The system can effectively assist to the medical specialists, allowing them to perform their activities in a more organized way, contributing to increase the medical campaigns productivity. Furthermore, the required training for potential patients for this system use is minimal since only involves receive/send SMS, a common activity in the daily cell phone use.

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