

# SN2SMS: Location-Aware Social Network Based SMS Health-Care System

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**Abstract:** In this paper, we introduce conceptualization of an intelligent health-care system (named as SN2SMS and read as Social Networks to Short Text Messaging) which sends personalized health-care messages prepared from content extracted from campaigns running on online social networks. This combination of online social networking with latest communication technology distinguishes this system from existing health-care communication systems that basically send hardcoded health-care recommendations to their subscribers. Another excellent feature of this system is that it does not diffuse short-text messages to its subscribers blindly. This system is supposed to categorize messages into location-independent messages and location-aware messages. Location-independent messages are sent to all subscribers while location-aware messages are sent only to subscribers of extracted location. Location-aware messages contain information about a disease most likely to be spread in that particular area.

**Keywords:** e-health, online social networks, mobile text messages

## I. INTRODUCTION

Latest internet technologies and software's are facilitating general public to find timely and relevant health information online. The revolution of social-networking is approaching the health-care solutions. Earlier, patients used to consume information through static information available on the web are participating dynamically and generating web content by sharing their problems. Use of online virtual communities in this regard is already showing its benefits to the patients. In addition to these online social communities, latest communication technologies are also being used for finding health-care solutions for people of remote areas where health-care facilities are lacking or beyond approach of ordinary people [1]. Health-care providers keep updating their customers about their medication timings and preventions by sending them mobile text messages.

This phenomenon of increasing online resources for health-care solutions has given rise to number of people searching for health-care information online. Recent statistic about U.S. adults seeking for health-care information online reveals that 59% of U.S. adults got information, care, or support from online health-care services<sup>1</sup>.

Campaigns against disease on social media have got lot of attention general public and very fruitful results have been obtained in this regards. For example, several Asian nations like Pakistan, Singapore and Sri-Lanka have opted for Facebook and Twitter to create awareness among public by diffusing the prevention measure against Dengue fever. These campaigns have played a vital role in fight against Dengue<sup>2</sup> (an infectious disease caused by a specific type of mosquito) especially in Pakistan where rate of deaths caused by Dengue were significantly reduced in year 2012. Quoting another example of campaign against diseases on social media, we refer to a Twitter mobile application developed in October, 2011 aiming to create awareness among general public for fight against breast cancer. Its developers donated 50% of the proceeds to the campaign. Another social networking campaign in this regard was run on the famous video blog YouTube. A video captioned as "Pink Glove Dance"<sup>3</sup> was prepared and uploaded to raise awareness for early detection of breast cancer. This campaign proved to be very successful with its 1.8 million views.

This growing popularity of social media among health-care information seekers and providers is definitely a positive sign and numbers of online health-care services are

<sup>1</sup> Health Online 2013: Pew Internet Statistics 2013, <http://www.pewinternet.org/Reports/2013/Health-online/Summary-of-Findings.aspx>

<sup>2</sup> <http://www.siasat.pk/forum/showthread.php?83293-Anti-dengue-campaign-launched-on-Facebook-in-Pakistan>

<sup>3</sup> [www.pinkglovedance.com](http://www.pinkglovedance.com)

increasing day by day. But the question arises that how many people are getting benefit of these online services? Does everyone on the earth have access to these services? Or are these services segregating a large part of the population? Yes, it is true. A large part of world population does not have access to these online services because of their govt. policies *OR* do not have Internet access at all. This phenomenon is known as *Digital Divide* and is explained in detail in following section. This digital divide phenomenon labels the use of online health-care services as “under-served” and therefore, we need a better platform to provide same kind of services which is accessible to relatively a larger part of population. We propose the use of mobile communication network for these types of services. Mobile communication is already being used for health-care services but not in the same intelligent fashion our system.

## II. THE DIGITAL DIVIDE

The “digital divide”<sup>4</sup> within a country—richer, urban dwellers having more access to the Internet and poorer, rural dwellers with less—and between countries affects the potential of many people to access its benefits. The “global digital divide” causes some countries to fall even further behind in technology, education, labor, democracy and tourism [6]. Without any doubt, the problem lies in availability of suitable Internet infrastructure within a country. Once access is provided to the digital content available online, this digital gap can be compromised.

According to ICT facts and figures 2013 of International Telecommunication Union (ITU), there are 2.7 billion people around the world using Internet which makes 39% of the world population. Figure 1, describes the statistics of Internet usage in different regions of the world with Europe having the highest Internet penetration rates (75 %) and Africa having the lowest (16 %).

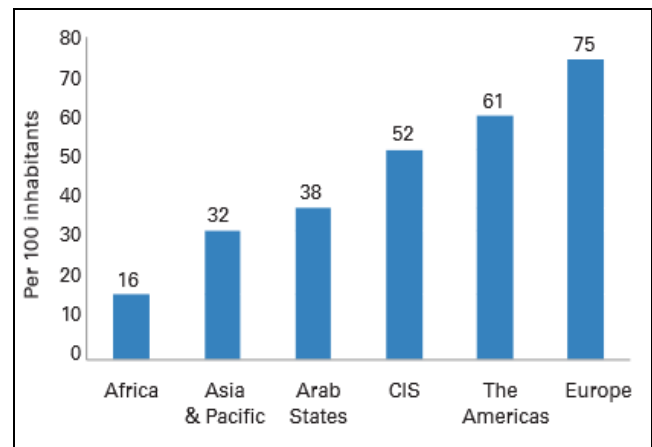


Figure 1: Internet penetration Rates in different regions<sup>5</sup>

Now if we compare Internet growth rates in developed and developing countries over times (from 2001 to 2013) then numbers are far apart (see table 1). Developed countries stay on better sides of the digital divide with Internet growth rate of 77 % in 2013 while developing countries reside on the other side the digital divide with Internet penetration rate of only 31%.

The countries that have an extraordinary developments regarding increase in Internet growth rates include Lebanon and Malaysia, with, respectively, 62% and 61% of households having access to the Internet compared to 20% of other countries in their regions.

	2001	2013
Developed Countries	29.4 %	77 %
Developing Countries	2.8 %	31 %

Table 1: Individuals using the Internet per 100 inhabitants in developed and developing countries

The statistics of digital divide and popularity of social media for health-care information raises serious concerns for development of a platform that transforms this social media health-care information in a form that is accessible by large part of the public. Surveys<sup>6</sup> have shown that mobile communication is more common among most part of the world population and therefore seems more appropriate platform for creating awareness among general public. According to the ITU, nearly 90% of people in the world use mobile phones (see figure 2) while only 35% of world

<sup>4</sup> <http://www.gfmag.com/tools/global-database/news-data/11942-internet-users.html#axzz2Och2Ec9V>

<sup>5</sup> ITU's ICT Facts and Figures 2013

<sup>6</sup> <http://battellemedia.com/archives/2012/02/nearly-90-of-the-world-uses-mobile-phones.php>

population have Internet access. Figure shows this comparison over the period of years. Health-care providers have been using mobile communication for health-care awareness but existing health-care systems lack dynamicity and socialism of online social networks. A health-care service of sending hardcoded messages to its subscribers seems very dull. In this paper, we propose structure of such health-care system that combines the advantages of both i.e., online social networks and mobile communication networks.

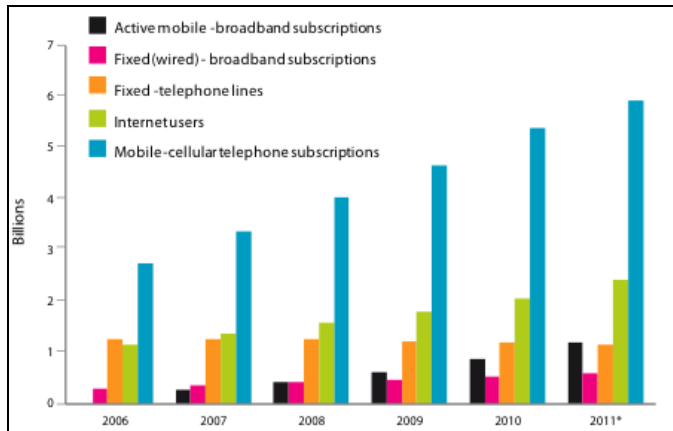


Figure 2: Statistics of mobile subscribers over the years

We try to entertain this issue by proposing basic structure of a system SN2SMS which extracts health-care information from online social media, transforms it and diffuse it over mobile communication network which is more common among public. In other words, we leverage the advantage of online social media to mobile communication networks by the use of short-text messaging service.

This paper is organized as follows: Section III describes the relevant literature work while section IV discusses major features of our proposed system. In section V, we describe basic structure of our proposed system. At the end, we conclude our paper.

### III. PREVIOUS WORK

Several existing health-care systems provide various health-care services using different state-of-the-art technologies. Most of these health-care systems have been taking support of online social media and mobile communication networks [2, 3]. In this section, we discuss several health-care systems exploiting online social media and communication technologies.

#### A. Using online Social Media

Web 2.0 technologies have expanded the traditional notion of online interaction into a broad and evolving online social media [4]. “Social media” refers to phenomenon of using online tools and platforms to share content and information through conversation and communication [9]. These online platforms include *Twitter*, *WordPress*, *Facebook*, *Tumblr*, *YouTube*, *StumbleUpon*, *Reddit*, *Mashable*, *LinkedIn*, and *Bebo* [8,11,12]. In addition to their conventional online social services, these platforms have been used for several purposes like raising money, building communities, and increasing awareness for health-care issues. For example, the Mayo Clinic<sup>7</sup> is a prime participant in social media ventures, with 2 million views on its YouTube account and over 10,000 Facebook fans [7]. Using this social platform, patients have been able to form their online identities and oncologists have a chance to stay connected to their patients.

A non-profit organization named as *Wellness Community* developed a Web site<sup>8</sup> to create awareness among teen cancer patients by communicating with each other in a private and safe environment. This web site helped connecting more than 15% of approximately 50,000 teen cancer survivors in the U.S.

In addition to the use of simple online informative health-care services, health-care providers are experimenting with use of unique and latest ideas to spread health-care information more effectively.

*Wikis* are online collaborations that let different users jointly work on web-based information to help communities plan for public-health emergencies<sup>9</sup>. *Wikis*’s users are responsible for reading and editing the available health-care information. *Ganfyd*, *Toxipedia* are famous wikis for health-care information.

Use of virtual computer worlds to create health-care awareness among general public has also made headlines in the leading newspapers. American Cancer Society experimented with *Second Life*. The American Cancer Society approached virtual volunteers through the *Relay For Life in Second Life* in 2005, and continued to empower these volunteers through a *Second Life* virtual office which opened on *ACS Island* in June 2007. Since 2005, the American Cancer Society has raised more than \$950,000 in *Second Life*. *Second Life* volunteers have the ability to reach out to

<sup>7</sup> [www.mayoclinic.com/](http://www.mayoclinic.com/)

<sup>8</sup> [www.grouploop.org](http://www.grouploop.org)

<sup>9</sup> [www.fluwikie.com](http://www.fluwikie.com)

millions of people all over the world, sharing the society's mission and advocating for those touched by cancer.

### B. Using Mobile Communication Media

Over the last few years, mobile technology is helping with chronic disease management by offering several services like reminding people to take medication at the proper time, extending health-care to underserved areas. In this section, we discuss some projects that have been developed for health-care using mobile technology to highlight its importance.

Text messaging platforms are rapidly becoming a popular and inexpensive way to educate the general public about disease and health hazards. A review of 25 studies on voice and text messaging in health-care reveals that mobile text messaging has caused lower failed appointments, quicker diagnosis and treatment [5].

*"The mobile phone is transforming how health services are delivered,"* said Dr. Frederick Muench, clinical psychologist and founder of Mobile Health Interventions. *"There is now substantial evidence that text messaging programs are effective, adjunctive and standalone interventions for a range of problem behaviors."*

Internationally, texting is being used to help curb outbreaks of diseases such as malaria and hepatitis. Even expectant mothers are now receiving free health tips once a week and other worthwhile information during their pregnancy and on into their child's first year of life.

Mobile text messaging has proved itself a very effective tool to promote healthy behaviors among patients. For example, the *White House* recently launched a mobile text messaging campaign to curb premature births and reduce infant health problems. Messages include information about birth defects, immunizations, mental health, and nutrition that proved to be significantly effective in creating awareness among pregnant women. Another useful service being provided through SMS is appointment reminders. Kaiser Permanente, one of the largest non-profit health-care companies initiated an innovative SMS-based patient reminder solution in year 2008. They developed an SMS-based tool for its users which allowed them for creating and managing patients' appointments. This project was able to save \$150 per appointment. Similarly, Aetna Health Plans<sup>10</sup> also announced a text-based SMS service for diabetic patients that included

SMS reminders regarding updated screenings, medical tests, and general health-care tips.

Importance of mobile text messaging is also being recognized on International level the United Nations launched a ten-day initiative intended to reach out to 10,000 people in Jinja, the second largest commercial city of Uganda. Thousands were reached through text messages to demonstrate the reach and potential of using mobile phones for health information and wellness promotion. The *Texting4Health* initiative invited residents of Jinja to participate in a short health quiz using text messages and met with great success throughout the area.

The PPTMS platform<sup>11</sup> enables responders to communicate by text message to anyone, anywhere using a short code and web-based interface, via a PC, laptop or any wireless enabled device. The application allows its users to register themselves for services like creating appointment reminders, having crisis support information, getting weekly vaccination tips.

In this section, we have discussed several health-care systems that leverage the help of mobile communication technologies to create health-care awareness among their users. It has been observed that such health-care solutions are not only beneficial for patients but also proved to be profitable for health-care providers. There is no doubt that the many opportunities for text messaging solutions for health-care providers should not be overlooked when prospecting for new businesses and maintaining profit margins. It is a clear, effective and inexpensive way to create new business while keeping current patients healthier. In next section, we describe our proposed system.

#### IV. SN2SMS: FROM SOCIAL NETWORK TO SHORT TEXT MESSAGING

In this section, we describe major features of our proposed system SN2SMS. It is equipped with following major features:

- ***Mapping online Social Communities to Real Communities,***

One of the very unique features of our proposed system is the mapping of existing online communities to real world social communities i.e. it will let the same information diffuse among the real world community which was being shared and delivered among members of an online social community. This feature could let

<sup>10</sup> [www.aetna.com](http://www.aetna.com)

<sup>11</sup> <http://www.preventionpays.org/PPTMStextprogram.pdf>

researchers compare the attitudes of members of real and virtual communities as the information is diffused across them.

- **Personalized health-care messages,**  
This feature distinguishes our proposed system from other existing health-care systems. This system is supposed to send health-care tips to people of the locality for which a certain piece of information is being spread in online social networks.
- **Not limited to health-care tips related to one disease**  
Another feature that stands our system unique from existing ones is that this system does not focus on a single disease for which that particular project is designed for or for which a user has registered him. This system is intended to send personalized health-care tips for diseases likely to spread in particular regions (like *Dengue* etc).
- **Location-Awareness**  
Another feature that makes our system distinct from existing health-care systems is that it extracts the geographic location from the online campaigns and sends a personalized message to users of that location. It categorizes the messages to be delivered into location-independent and location-aware messages. Location-independent messages are sent to all users while location-aware messages are sent to users of extracted location.

## V. SN2SMS: SYSTEM ARCHITECTURE

In this section, we describe the basic structure of the proposed system by highlighting major elements of the system (see figure 3).

1. **Data Extractor:** This module is designed to use application programming interfaces (APIs) provided by several online social networks to extract required information.
2. **Data Filter:** Data filter will extract the required information from the whole data extracted from online social networks i.e., health related information.
3. **Entity Extractor:** This module will extract important entities from health related information like location, medicine names if any, names of health-care professionals or organizations, etc.

4. **Message Personalizer:** This module is supposed to use data summarization techniques to prepare a personalized message by embedding entities extracted. It also tags a message as location-independent message or location-aware message as a guiding mechanism for message delivery module.
5. **Message Delivery Module:** Once a proper message been prepared then it is sent to a recognized location by message delivery module. This module distinguishes between location-independent messages and location-aware messages by sending location-independent messages to all of its subscribers while location-aware messages are only sent to users of extracted location.
6. **User Subscriber Module:** This module is responsible for subscribing users willing to get services provided by our system.

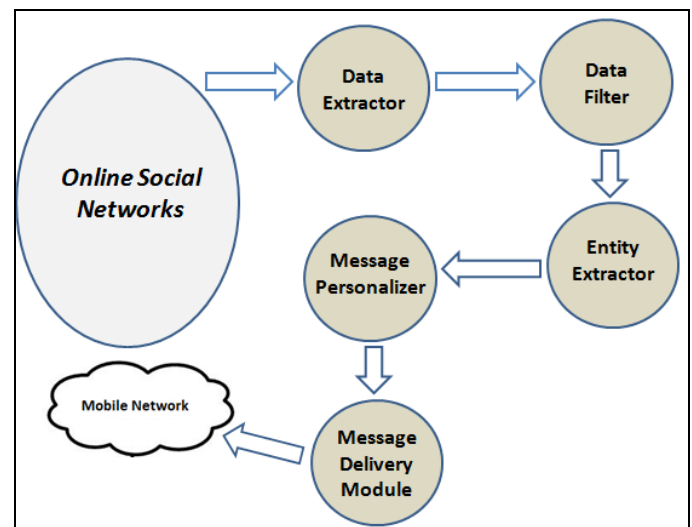


Figure 3: Figure showing basic elements of our system

## VI. CONCLUSION

This paper proposed the basic structure of a very unique health-care system SN2SMS which is result of a combination of online social networks and mobile communication networks. Extraction of social networks information and using mobile text messaging for its spread is a unique idea. The idea of distinguishing between location-aware and location-independent messages is unique in its own. It gives a sense of intelligence to this system. Besides this, we described some major achievements of the past as part of related work section. We are planning to give this conceptualization a solid implementation as part of our future work.

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