

## Mobile SMS based Self-Medication Support System for Health-care

Malik M. Saad Missen  
Dept. of Computer Science & IT,  
The Islamia University of Bahawalpur

Tareef Ali Khan  
Dept. of Computer Science & IT,  
The Islamia University of  
Bahawalpur

Hina Asmat  
Dept. of Computer Science  
International Islamic  
University Islamabad

Nadeem Salamat  
Department of Mathematics  
Karakoram International University  
Gilgit-Pakistan

Nadeem Akhtar  
Dept. of Computer Science & IT,  
The Islamia University of Bahawalpur

**Abstract** – In this paper, we propose a short text messaging(SMS) based health-care system ideal for rural areas where one cannot find proper health-care because of scarcity of doctors and other health-care resources. This system especially focuses on issue of self-medication mostly prevailing in rural areas. We discuss our system by taking Pakistan as our case study. In addition to this, we also discuss the social network to be formed as a result of this system. We discuss how the data obtained from this system can be adapted to form a social network. We also discover how this social network can be used to improve health-care system.

**Keywords** – Short text messaging, mobile health-care, social networking, rural health

### I. INTRODUCTION

Most of the elements of an ideal health-care system are lacking or not up to the standards in Pakistan. Health-care indicators, like health-care funding and health-care infrastructure, are very poor. About 17% of the population is malnourished and by 2007, only 85 doctors were available for every 100,000 Pakistanis<sup>1</sup>. Basic health-care in Pakistan is provided by small/large scale health-care units. Basically, there are four types of health-care units established in Pakistan as explained in table 1.

According to Ministry of Health, a BHU is responsible for providing health-care to a population of 5,000 to 10,000 people populated over an area of 15 to 25 square miles. In practice, this diameter is wider most of the time. This health-care infrastructure seems appropriate but it is being suffered by many problems discussed below:

**Table 1:** Basic structure of health-care units in Pakistan<sup>1</sup>

Health Facility	Location
District Head Quarter Hospitals (DHQ)	Located at district headquarters
Tehsil Headquarter Hospital (THQ)	One in each tehsil
Rural Health Center (RHC)	Markaz (Serving a cluster of 4-6 union councils)
Basic Health Unit (BHU)	One in each union council

#### A. Problems with Basic Health Units (BHU)

- **Location:** Considering the fact that rural areas generally lack good transport facilities, the location of BHUs becomes very important for better use of health services. It has been observed that most of the time BHUs are situated at a location far from center of the population. Sometimes, it is situated on such a hidden place that even if someone has arrived on the location, it becomes difficult to locate it.
- **BHU Condition:** Most of the BHUs are in very poor condition. Lack of routine maintenance and basic facilities like electricity, clean drinking water, indoor toilets, etc. cause worse hygienic condition that could only help deteriorating health of people working there. Highly influenced people of the area use BHUs for their personal functions like marriages or election campaigns. Even it has been reported that people are using BHUs for tying their animals. Lack of visits by

<sup>1</sup>Failure Analysis of Primary Healthcare in Pakistan:  
<http://www.insaf.pk/Portals/0/webmgmt/irw/FAILURE%20ANALYSIS%20%20%206-28-09.pdf>

district inspection teams encourages continuation of such activities in BHUs.

- **Transport Problem:** Poor education system in rural areas gives an advantage to people of urban areas to continue their higher studies in a less competitive environment. Therefore, most of the health-care staff recruited to work in BHUs comes from urban areas. On one hand, poor living conditions of rural areas make it inhabitable for people of urban areas, while on the other hand, lack of transportation to BHU's locations makes the journey a "mission impossible" especially in difficult weather conditions. Using one's personal conveyance is a hard choice because there is no realistic reimbursement for wear-and-tear on use of one's own vehicle.
- **Absenteeism to work in Villages:** It has been observed internationally that medical professionals of urban areas abstain from working in rural areas (*World Bank Year 2000 report*). In a survey it was found that only 17% of medical students interviewed were ready to practice in rural areas after their graduation [3]. It has been reported that the health-care staff generally works in shifts and share their salaries under a secret agreement among them. For example, doctors might give a portion of his/her salaries to lower staff to get the facility of visiting health-care facility only once a month.

All of above mentioned problems make a basic health unit inaccessible and useless entity for providing basic health services to people of remote areas. However, we think that if this infrastructure is supported by latest mobile technology then it will not only prove its worth but use of mobile technology will also help improve health of individuals. Therefore, in this paper we propose a system which aims at providing basic health-care to its users by using the mobile short messaging service (SMS). The feasibility of using SMS technology is justified by latest surveys on use of mobile phones in Pakistan even in rural areas. According to Pakistan Telecommunication Authority (PTA), the numbers of mobile users in Pakistan have reached 105.15 million [3]. According to *LIRNEasia's* 2009 survey, 60% of the mobile phone owners of Pakistan, the ratio of people using SMS is divided among men and women as 51 percent 33 percent respectively. SMS usage across genders and age groups of poorest 100 million Pakistanis is shown in table 2.

**Table 2:** SMS Use amongst Pakistan's poorest 100 million by Age and Gender [3]

Demographics	Phone owners that use SMS
Male	48.9 %
Female	30.4 %
15 – 25 Years	59.8 %
26 – 35 Years	39.4 %
36 – 45 Years	36.9 %
46 – 52 Years	30.0 %
53+ Years	9.7 %

These statistics demonstrate that SMS technology could be a leveraged to provide health-care to its users. The system to be discussed in this paper proposes to use mobile SMS technology focusing on major and more practical problems of people living in rural areas. Major focus of our proposed system is on self-medication.

## II. SELF-MEDICATION

Self-medication is defined as obtaining and consuming drugs without the advice of a physician either for diagnosis, prescription or surveillance of treatment [6]. Taking medicines on one's own i.e. without doctor's advice, using old prescriptions to buy medicines, asking for medicines from friends or relatives who were prescribed some medicines for having similar symptoms are examples of self-medication [7]. Increasing rates of self-medication has caused a great concern among health-care professionals. Its prevalence in European countries is as high as 68%, while much higher in the developing countries with rates going as high as 92% in the adolescents of Kuwait while 31% in India and 59% in Nepal [5]. In Pakistan, it has been reported up to high rates of around 51%. Despite many efforts, this phenomenon keeps on increasing its prevalence especially among women and students of young age. A study [5] reveals a shocking result that almost 76% of university students in Karachi are indulged in self-medication. While lack of education and health-care awareness are major factors behind this phenomenon, some social factors also playing their role in this increasing trend of self-medication. Self-medication is on the rise in societies where people are more closely attached socially i.e., people use to take care of each other or at least they show apparently that they give value to each other. Population of rural areas generally lives in closed communities where people pay regards to each other by asking opinion of others and honor them by acting as per their opinions. Generally, people of remote areas keep medicines at home and in case of any problem like fever, flu, headache, etc., they take these medicines. It often

happens that one has some medicines at home but does not know for what purpose it is. Consulting someone is like a “hit or miss”. In this paper, we propose a system that tries to handle this problem using latest communication and relatively more pervasive technology of mobile communication. It does not guarantee to control self-medication and bring it to zero level but it gives a more reliable health-care facility to people who are indulged in this practice.

This paper is organized as follows: In section III, we describe the related work. Section IV describes our proposed system in detail with all of its services. Section V describes a very promising research problem generating from the social network our system is supposed to create. At the end, we conclude the paper and give some remarks about the related future work.

### III. RELATED WORK

SMS based health-care services can be categorized in many different types:

- Different telecommunication companies provide healthcare tips as part of their different SMS packages (like Airtel in India<sup>2</sup> and Zong in Pakistan in Flutter SMS package),
- To make a significant impact on a hospital operations and patient care<sup>3</sup>,
- To locate a health-care provider [1],
- To remind about appointments [2],
- To improve communication among health-care providers [2],
- To monitor safety of health-care workers [2,9],

### IV. SMS BASED SELF-MEDICATION SYSTEM

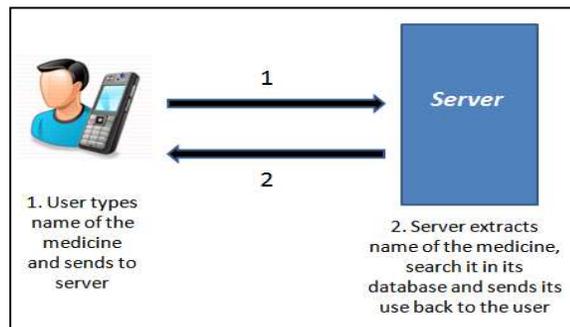


Figure 01: Overview of SMS based Self-Medication System

With the growth of mobile technology, its use is not limited to communication only but is being used in providing many state of the art technical services such as online banking, online shopping, etc. We propose a SMS based self-medication system that could help people of remote areas to improve their self medication traditions. It provides technical infrastructure as its support.

#### A. Users

Anyone with a mobile phone set capable of sending and receiving short text messages and a mobile connection is a valid user of this system. Users will be given a number on which they are supposed to send a message in a prescribe format. The system is supposed to give them feedback.

#### B. SMS Format

The users are supposed to follow this format for sending an SMS expecting a self medication advice on a certain medicine:

MED: *Medicine Name as Written on its package*  
 TAB/SYP/INJ SC: 1/2/3/4/5 [LOC: Description of user’s location]

Where SC stands for service code and could be one of the followings:

Table 03: Table describing service codes and their description

Service Code	Description
1	For determining the purpose of the medicine,
2	For determining dose of this medicine in mg age wise,
3	Side Effects of this medicine,
4	When not to use this medicine,
5	For determining the nearby health-care specialists related to the diseases related to this medicine. In this extra code of LOC is to be sent that should be location of the patient written in words.

It is to be noted that considering the length of the SMS, only one code is allowed to be sent at one time. If no code is mentioned then by default code 1 is considered and purpose of the medicine is returned.

<sup>2</sup><http://www.airtel.in/wps/wcm/connect/Airtel.in/airtel.in/home/whats+new/pg-mhealth>

<sup>3</sup><http://www.kiwanja.net/media/docs/Rural-Healthcare-SMS.pdf>

### C. System's Feedback

The system is supposed to send a feedback back to the user according to the code sent in SMS:

<Medicine Name as Sent>:

- **Purpose:** Main purpose of the medicine described in simple language,
- **Dose Prescribed:** Age wise dose to be mentioned with warning of requiring doctor's advice,
- **Side Effects:** A simple description of side effects mentioned,
- **When not to use:** This field is very important that described when a user should not use this particular medicine,
- **Recommended Health-care Specialist:** This field recommends one to three health-care specialist that are available near to the location user sent in his SMS.

SMS sent by user asking for locations of nearby doctors	SMS sent by user asking for purpose of Disprin
MED: Disprin TAB SC:5 LOC: Zahir Pir	MED: Disprin TAB SC:1
Disprin: 5) Dr. Rifat Ali Akbar, Missen Abad, 6KM, Dr. Rabia Basri, Missen Abad, 6KM	Disprin: 1) Used to reduce headache, migraine, nerve pain, toothache, sore throat, period pain
Returned reply from our System	Returned reply from our System

Figure 02: Two different SMS formats sent by users and their replies as returned by the system

### V. SELF-MEDICATION SOCIAL NETWORK

Data collected from this self-medication SMS system can be used to build a social network where nodes can be location of the users or the edges between nodes can be labeled by the name of the medicine. Basically the resultant graph would be a undirected multi-graph i.e., it can have multiple edges between two vertices [8]. There is an edge between two locations if same medicine (or same type of medicine to be more flexible) was asked from both locations. A number of nodes can form communities if they share same medicine which means these locations are affected by same kind of health problems which could be very useful to detect disease flows across communities. This could help the concerning authorities to take necessary health-care actions and also can draft policies for future.

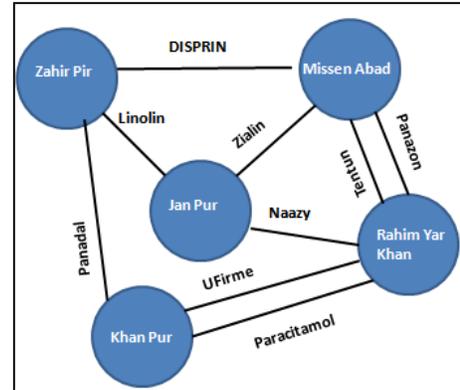


Figure 03: Social Network of Locations and Medicine

### VI. CONCLUSIONS

In this paper we propose a self-medication SMS based system. We take Pakistan as our case study. We also discuss social network to be formed as a result of this system. This paper describes drawbacks of current systems and also dictates how our proposed system can tackle these problems and how the social network formed as a result of this system can be used to identify health problems in different regions of Pakistan

### REFERENCES

- [1] Rohit Banga, Akhil Langer, Ankush Mittal, Parikshit Sondhi, *SMS based Natural Language Interface for Locating Health-care Service Providers, Technical Report*, Telecom Regulatory Authority of India, April, 2010
- [2] Rifat A. Atun, Soalen R. Sittampalam, Anita Mohan. Uses and benefits of SMS in Health-care Delivery. Discussion Paper, Imperial College London, 21 Jan, 2005
- [3] Farooq, U. Doctors Perception about Staying in or leaving Rural Health Facilities IN DISTRICT ABBOTTABAD. *Journal of Ayub Medical College; 16(2)*, 2001.
- [4] J.L. Williams, A. Gilchrist, M. Heide. SMS Engagement in Pakistan: A Practical guide for Civil Society, the Humanitarian Sector and Government. June, 2011. PEPL, UK
- [5] Syed Nabeel Zafar, Reema Syed, Sana Waqar, Akbar Jaleel Zubairi, Talha Vaqar, Mehriene Shaikh, Wajeeha, ousaf, Saman Shahid, Sarah Saleem, Self-medication amongst University Students of Karachi: Prevalence, Knowledge and Attitudes, JPMA, April 2008
- [6] Montastruc JL, Bagheri H, Geraud T, Lapeyre-Mestre M. [Pharmacovigilance of self-medication]. *Therapie* 1997; 52: 105-10.
- [7] Filho L, Antonio I, Lima-Costa MF, Uchoa E. Bambui Project: a qualitative approach to self-medication. *Cad Saude Publica* 2004; 20: 1661-9.

- [8] Paul E. Black, Multigraph at the NIST Dictionary of Algorithms and Data Structures
- [9] Kamran Ahsan, Hanifa Shah, Paul Kingston: RFID Applications: An Introductory and Exploratory Study, IJCSI Volume 7, Issue 1, January 2010