USABILITY ANALYSIS OF SMS ALERT SYSTEM FOR IMMUNIZATION IN THE CONTEXT OF BANGLADESH

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Abstract
Both the market and academia strongly encourage the development of usable systems, and they do so by relying on a number of standards, guide-lines, research and good practice streams. Unfortunately, in the health sector, whilst being the owner of standards under many purposes and topics, seems still falling and running behind as the conceptual issues and practical implications of usability are concerned. In this study, it was found that rapid growth of mobile applications through SMS increases in a significant way in developing countries particularly in Bangladesh. Public satisfaction was highly shown in mobile health services through SMS. In our paper, usability has been analytically investigated throughout a simulated health oriented action setting and against a prototype of SMS based health services in Bangladesh, and several provoking conclusions in terms of "rethinking usability" applied to academic actions and decision making have been derived. Various health institutes can be influenced by this study to challenge existing difficulties against usability potential.

Keywords: ICT, mHealth, Mobile applications, SMS, Usability

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1. INTRODUCTION

No individual or organization, no matter which sector or field they operate, would ever consider managing any relevant amount of information without relying on some sort of Information Technology (IT) and Information Management System (IMS), today; and not so just in order to support more or less "demanding" (computationally speaking) tasks, but also and mainly for simpler reasons, from retrieving to sharing accurate information for example, especially when such jobs involve or occur within distributed environments. This is obviously even truer when large-scale, real-time complex systems are considered: and the larger and more complex the IMS, the more important its usability.

Mobile phone is one of the most innovative technological tools in the past decade. It is rapidly growing all over the world. Millions of first telephone owners made text messages as a part of their lives. Nowadays several ways of usage have been made to provide various educational, banking and health services using mobile phone. These services take various forms like SMS based grade checking, information fetching, mobile learning etc.

There is significant potential for the use of mobile telephony to improve health service outcomes and data management. Opportunities include: serving as a less costly substitute for existing interventions; providing interactive functions that multiply the power of existing interventions; and serving entirely new functions. The use of mobile technology in health services (mHealth) has the potential to create more than 5 billion points of contact between consumers, healthcare workers, health system administrators and firms in supply chains for health commodities. Since its first appearance and within its ongoing meaning definition process, usability has been thoroughly investigated and pursued, mainly under a "Health care" perspective, by both administration and academia.

This paper aims at highlighting a set of "affordances" (arguments, hypotheses, suggestions, issues and provocations) to let usability become a primary factor to this health care organization from both government and NGOs.

2. LITERATURE REVIEW

Existing technologies like the Internet can be used to help doctors working in isolated rural villages to access up-to-date medical information and communicate with colleagues, and even to diagnose illnesses and treat patients. But in developing countries these health workers who care for 80 to 90% of the populations live in rural areas that are at times impassible and have no meaningful access to the Internet [1]. The rapid growth and widespread use of wireless technologies provides the best opportunity to reach these isolated health workers.

The term mHealth has been described extensively by several authors [2, 3]. Generally the term refers to the use of mobile

telecommunications in provisioning healthcare. Preliminary research has already shown that the application of mobile devices within the health sector is promising. Literature presents the use of mobile devices in health [4,5,6,7] though those that seems to have drawn keen interest especially for use in developing countries are those that implement text messaging [8,9,10,11,12,13] a feature of mobile phones, commonly known as SMS. Text messaging seems to have been successful for various reasons. Aside from being cheap and having low bandwidth requirements, it is also easy to use and is supported by all cellular phones; both feature and high-end. The minimal usage of mobile devices mainly the Personal Digital Assistant (PDA) in health in Kenya has been evidenced in the areas of data gathering, disease surveillance and epidemic tracking [14] yet the use of the mobile phones as shown in existing literature to have been useful in delivering healthcare services elsewhere has been left largely unexplored.

The status of the communication infrastructure and the capabilities of mobile phones in this region provide a good basis for the use of SMS for health care delivery. Such phones also present inherent limitations in terms of display size and computational power and battery life [6, 7, 12, 15] and hence, these would be key design requirements to be considered in developing mHealth applications.

3. REQUIREMENT GATHERING

Before any development of the system began, a consultative phase was initiated to investigate the knowledge sharing problem with the several health service organizations and some new parents. Meeting with 40 parents and three endocrinologists were held. From the session, the following conclusion was drawn.

- As there is no source which consistently provides the info of child health care and vaccination, parents have to go to hospital or clinic to get the necessary info. This is quite tiresome and is not always an effective method. After the birth of baby, some extra chore develops. As a result visit to hospital become even more difficult for people.
- Most of the people forgets to take the later doses of the vaccination in due time so first doses became useless.
- In fact many parents don't register their child birth just because the process of registering is tiresome. So it would many parents as well as the government if they can register the child birth through a single & simple SMS.

We visited Icddr,b for child vaccination schedule. Icddr,b (International Centre for Diarrhoeal Disease Research, Bangladesh) is one of the most renowned health service organizations in Bangladesh. They guided us by giving some information about child diet and vaccination. The child vaccination schedule is given below.

Table -1: Vaccine Schedule

Age	Vaccine
Birth	BCG, Oral Polio (first dose), Hepatitis B (first dose)
6 weeks	DPT (first dose), Oral Polio (second dose), Hepatitis B (second dose)
10 weeks	DPT (second dose), Oral Polio (third dose)
14 weeks	DPT (third dose), Oral Polio (fourth dose), Hib (first dose)
20 weeks	Hib(2nd)

4. SYSTEM ARCHITECTURE

Stage 1: People will register with hospital database through SMS (e.g. child name, dob to 1616)

Stage 2: After registration, child's parent will receive sms about 1st dose of vaccine.

Stage 3: In every 6 months or later, parents will automatically receive sms from server about different vaccine according to child's age
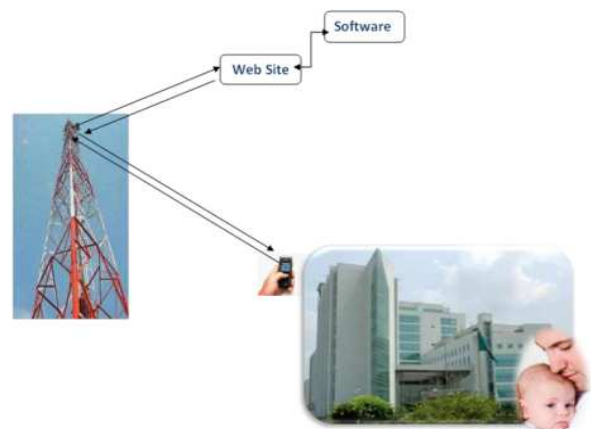

Fig -1: Data flow diagram

Fig -2: Sample SMS

5. RESEARCH QUESTION

How SMS technology based "Virtual Health Care Service" could be a successful tool to aid people?

To answer the research question researchers break down with the following specified objectives:
•   Identify the limitations with current technologies
•   Identify availability of mobile phones in Bangladesh
•   Identify users satisfaction and usability level

The purpose of this report is to develop a usability testing on SMS based health care support system in the developing countries.

5.1 Research Method

Both primary and secondary data were collected for this research. Both qualitative and quantitative research methods were applied to develop this research. This research is mainly divided into two areas. One is for the people who are going to using "Virtual Health Care" system and the other is health care related authorities who will upload the updated notice and materials to deliver people. The methodology used in this paper is based upon an investigation of current mobile based health care support applications in a variety of countries and then comparing those applications in order to suggest improvements.

A framework has been developed for usability testing which identifies the efficiency and effectiveness of SMS based health care system.

There are six Hypotheses to analysis the result with Z test a survey on 57 sample size with structured questionnaire of simple random sampling.

5.2 Hypothesis

Table -2: list of hypothesis

No	Hypothesis
H1	Accomplish the task is done quickly by using this service)
H2	I am satisfied with number of steps included
H3	It is easy to understand what is needed
H4	It is easy to learn this system
H5	SMS based information satisfactory rather than previous manual system of exchange or delivery of information

6. USABILITY FRAMEWORK

As the ISO definition suggests, usability is a multi-dimensional concept. There are often compromises to be made, trading off different goals to achieve a usable product.

It was said that efficiency, effectiveness and satisfaction are independent qualities of the system [16].

To test usability of SMS based system a framework has been developed
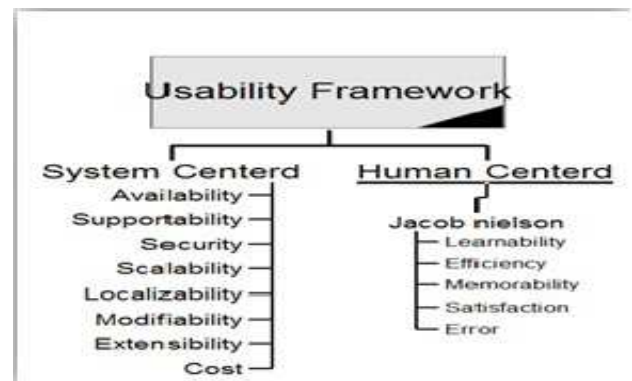
6.1 System Centered Approach

Availability: Despite of the difficult business environment, the mobile communications sector is growing rapidly and is cited as the fastest growing industry in Bangladesh. According to a report by Telenor ASA(2008) The mobile communications sector began in Bangladesh with the licensing of a single company, Pacific Bangladesh Telecom Ltd (PTBL) in 1991. In 1996, three national GSM (Global System for mobile communication) licenses were granted and this opened upon the mobile communications sector to a wider subscriber base. Currently, six mobile network operators are currently licensed to operate in Bangladesh. The total number of Mobile Phone Active Subscribers has reached 101.205 million at the middle of June 2012.From [17]; it was found the number of mobile phone subscriber in Bangladesh at the moment.

Table -3: Active mobile phone user

Operator	Active subscriber
Grameen Phone Limited(GP)	42.372
Orascom Telecom Bangladesh Ltd(Banglalink)	26.309
RobiAxiata Limited(Robi)	21.697
Airtel Bangladesh Limited(Airtel)	7.557
Pacific Bangladesh Telecom Limited (Citycell)	1.425
Teletalk Bangladesh Limited(Teletalk)	1.8
Total	101.205Millions

It means mobile devices are becoming a part of daily life for Bangladeshi people. People are not only using mobile phone for communication but also as a tool to transfer information.

Localizability: SMS can be used in any kind of environment or area. Students, who are out of campus on vacation time, will easily get information of the university through SMS.

Supportability: SMS supports in any kind of mobile device. Reliability: SMS service is available 24/7; as a result, it is very reliable.

Security: SMS is very secured technology. Every SMS can be tracked. Only registered students will get specific SMS through mobile. Only admission and university information modules are open to general people outside the university.

Technical Feasibility: SMS based virtual campus was developed using PHP and MySQL. Both are open source software and free. Whole project was developed by following OOP method. As it is developed by PHP, as a result it can handle 80 users that means per second 80 SMS. Since, it is totally object oriented, so it can be extended based on requirement.

6.2 Human Centered Approach

Knowledge of use:

A survey was conducted to find out knowledge of mobile phone users about SMS service where sample size was 57. Findings of the survey questionnaire on the knowledge of use are given in the table below

Table -4: User response

General category	Response
Availability of device	90%
Available to family	83%
Frequency of use	95%
Readability	75%
Training	23%
Receive notification from government or other organization	25%

Usability is a qualitative attribute that assesses how easy user interfaces are to use. The word "usability" also refers to methods for improving ease-of-use during the design process. Usability consultant Jakob Nielsen (and computer science professor Ben Shneiderman has written (separately) about a framework of system acceptability, where usability is a part of "usefulness"[18, 19] and is composed of:

Learnability: How easy is it for users to accomplish basic tasks the first time they encounter the design?

Efficiency: Once users have learned the design, how quickly can they perform tasks?

Memorability: When users return to the design after a period of not using it, how easily can they reestablish proficiency?

Errors: How many errors do users make, how severe are these errors, and how easily can they recover from the errors?

Satisfaction: How pleasant is it to use the design?

7. DATA COLLECTION AND RESULTS

From the collected data, we have found that, 42 % respondents strongly agreed about their effective use of mobile phones, 50% respondents satisfied with number of steps included in our system, 21 % believed system is very easy, 51% of respondents prefer SMS based system rather than manual system.

Since, in every single hypothesis Z cal > Z tab, so Value the null hypothesis is rejected at 5% significance level, it can be said that people rate the concept behind SMS based health alert system is an effective tool for government and health NGOs. Learn ability, reliability and satisfaction rate is higher in this system.

Table -5: hypothesis analysis

	H1	H2	H3	H4	HH5
A)Strongly Disagree(1)	2	0	5	0	0
B) Disagree(2)	5	3	4	2	1
C)Neither Agree nor Disagree(3)	14	7	20	11	15
D)Agree(4)	24	28	16	15	21
E)Strongly agree(5)	12	19	12	29	20
Total	57	57	57	57	57
Average	3.333	3.714	3.127	3.841	3.667
Standard Deviation	1.071	0.899	1.202	0.972	0.912
Z-test	5.877	10.196	3.939	10.415	9.659
Alternative Hypothesis	Accepted	Accepted	Accepted	Accepted	Accepted
Result (Zcal>Ztab)					

CONCLUSIONS

The popularity of the application of mobile devices in health sector is gaining attention more and more with the tremendous growth of the mobile phone itself. In this paper, the usability has been analytically investigated throughout a simulated health oriented action selling and a model of a SMS based health service proposed. This small scale research study is not enough to commend on the efficacy and efficiency of this SMS based immunization system. However, the study suggests that it is possible to develop SMS based virtual health services in Bangladesh. By focusing on new devices and technologies to be adopted by and within the health sector, we have addressed several issues. This improved information transmission will save time and energy at different layers of health administration thereby reducing the unnecessary work-load and paper work in relevant functionaries of health institutions.

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BIOGRAPHIES

Dr. Touhid Bhuiyan is working as an Associate Professor at the Department of Software Engineering, Daffodil International University (DIU). His research interests are in intelligent recommendations, social network, trust management, database management and e-Learning in general. Before joining at DIU, he was employed by several renowned organizations including the Queensland University of Technology, University of Western Australia, University of Western Sydney and Central College Sydney. He has more than 16 years experience in teaching, research and working at

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Imran Mahmud is currently working at Daffodil International University as a senior lecturer in the Department of Software Engineering. Previously he worked two years at International University of Business Agriculture and Technology (IUBAT) as a faculty of Computer Science and Engineering. He has finished MSc. in Software Engineering from University of Hertfordshire (www.herts.ac.uk), UK in 2009. Before his masters he has spent three years in industry, working in IT and project management, business application development, software design and consultancy. Again, He is also working as part time IT consultant in Civil Service College Dhaka (www.csc.edu.bd) and a software company called jhoroTEK (www.jhorotek.com).

Ms. Banassri Alam is working as a research student of Department of Computer Science and Engineering at East West University, Bangladesh. Apart from being a student, she is also working as manager at Grameenphone Ltd, the largest telecom company in Bangladesh. During her study period, she worked with mobile phone based technology like SMS, J2ME, jQuery mobile apps etc. Ms. Banassri had her internship on "Analysis Capacity Planning & Design of Telco Contact Center". She achieved 85% during her master's degree.