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SMS-Based Systems: Towards Implementation of Mobile Discussion Groups

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Abstract: There have been a worldwide increasing number of mobile phone users as years go. Although mobile phones can include many features, most of users use their phones as simple devices for voice calls and Short Message Service (SMS). SMS provides a convenient means for people to communicate with each other via mobile devices. There are basically three kinds of interactions provided by SMS-based system; one way only, two ways, and SMS based chat. However there have been identified weak points of each of these interaction methods. Some are; poor support for forum/group discussions, demand for use of multimedia, GPRS or 3G enabled mobile phones, limitation of SMS per day/person, the need for signing up on the web to be able to use the system, and special software requirements. Due to the various identified challenges in each of the interaction method, the paper suggests an implementation of Mobile Discussion Group as an SMS system that provides more friendly group-based interaction.

Keywords: Mobile Communication, SMS, Mobile Discussion Group.

1. Introduction

Communication as one of the integral parts of science has always been a focus point for exchanging information among parties at locations physically apart. The term ‘mobile’ has completely revolutionized the communication by opening up innovative applications that are limited to one's imagination [1]. Today, mobile communication has become the backbone of the society. According to [6] the development of mobile communication technology has created a new possibility for information exchange reaching out a greater number of people than traditional wired methods. This technology has high potential to increase access to communication services in areas where infrastructure constraints exist. Mobile phones have played a key role in facilitating the entire communication process.

Statistics shows that there have been an increase number of mobile phone subscribers as years go worldwide, and in Africa specifically. At the end of the year 2012, Africa is projected to have 561 million mobile subscriptions from about 55 million mobile subscriptions in the year 2003. Mobile penetration will also rise from just five per cent in the year 2003 to well over 53 per cent by the end of the year 2012 [2]. The high ratio of mobile cellular subscriptions to fixed telephone lines and the high mobile cellular growth rate suggest that Africa has taken the lead in the shift from fixed to mobile telephony, a trend that can be observed worldwide. Figure 1 summarizes the number of mobile subscribers and penetration in Africa for eleven consecutive years.

Although mobile phones can include many features and may seem overly complex, many phones aimed at new users in developing and developed countries are simple devices that emphasize voice calls and Short Message Service (SMS) [3]. SMS provides a convenient means for people to communicate with each other using text messages via mobile devices or Internet connected computers. Each message can contain at most 140

bytes (1120 bits) of data; the equivalent of up to 160 English characters. [5] added that the SMS is restricted to 160 characters per message. Longer text messages may be sent by MMS (Multi Media Service), a system which also can transmit tightly compressed images or sound. So far, MMS messaging is used only in some SMS-based television formats, for sending small images [4]. SMS is a feature available on all mobile phones which allows a small amount of text to be sent between one user and another [3].

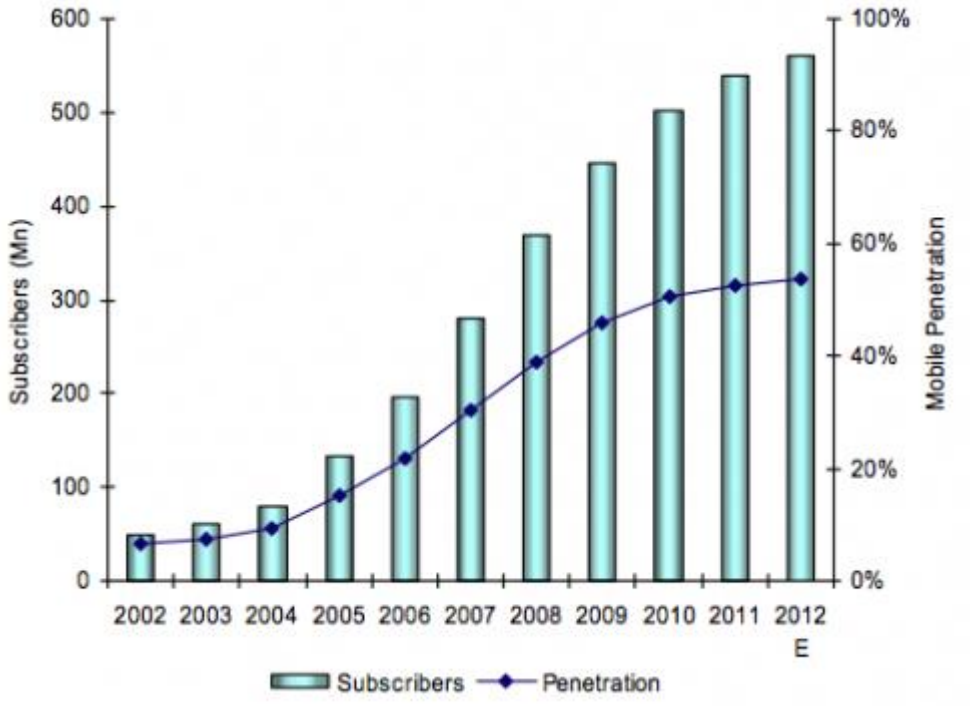

Figure 1: Africa – Mobile Subscribers and Penetration (2002-2012), Source: *[2]*

The SMS allows the exchange of short messages between a mobile station and the wireless system, and between the wireless system and an external device capable of transmitting and optionally receiving short messages. The external device may be a voice telephone, a data terminal or a short message entry system. The SMS consists of message entry features, administration features, and message transmission capabilities. These features are distributed between a wireless system and the SMS message center that together make up the SMS system. The SMS message center may be either separate from or physically integrated into the wireless system [2].

Short message entry features are provided through interfaces to the SMS message center and the mobile station. Senders use these interfaces to enter short messages, intended destination addresses, and various delivery options. SMS administration features include message storage, profile editing, verification of receipt, and status inquiry capabilities. The SMS transmission capabilities provide for the transmission of short messages to or from an intended mobile station, and the return of acknowledgments and error messages. These messages and acknowledgments are transmitted to or from the mobile station whether it is idle or engaged in a voice or data call [2].

SMS-based systems developers have been introducing systems that facilitate user communications by providing different kinds of text messaging interactions. This paper generally surveyed different SMS-based systems for the aim of suggesting a better and more efficient forum or groups based SMS system. More specifically, the objectives of this paper were:

- To identify different types of text messaging interactivity of existing SMS-based systems

- To identify weaknesses of the existing SMS-based systems
- To suggest possible ways in which forum or group based SMS systems can be designed to overcome the identified weaknesses

To arrive at meaningful deductions this study posed the following research questions:

- What different types of text messaging interactivity exist in the presented SMS-based systems?
- What are the weaknesses of those interaction methods of the existing SMS-based systems?
- How well can the forum or group based SMS systems be designed to overcome the identified weaknesses?

1.1 Why SMS-Based Systems?

The increasing number of mobile subscribers entails the increasing number of users who have access to SMS. One of the aims of having a mobile phone to many users is to have access to SMS [3]. While text messaging has its limitations, it is still the only guaranteed way to reach all mobile phone users. A single SMS can be powerful, saving the recipient a lot of time and unnecessary travel, increasing trading opportunities or acting as a call for help. Text messages can be automated and simple text messaging systems can be run using low cost computers and cheap mobile phones. It is further emphasized that SMS based services can be done by anybody (without the help of retailers), at any time (at the convenience of the user) and it can be accessed anywhere [4]. [8] added that SMS is a very inexpensive method of communication. 160 characters take up as much room as a one-second voice call. SMS messages can also be sent out to huge groups of people with the single press of a button.

System based on SMS technology posses increased reliability since it uses the store and forward transmission method. This allows the SMS messages to reach the server even if it was temporarily switched off or unavailable [7]. It is further argued by [9] that we cannot assume that all users carry multimedia-rich mobile phones, iPads, Personal Digital Assistants (PDAs), Ultra mobile personal Computing (UMPCs), netbooks, or notebooks. What we can assume is that most users in both developing and developed countries only carry basic mobile phones for voice and SMS communication. Therefore, when we consider ubiquitous access (other than Web-based access) to information for our system users, we must employ basic and trusted technologies such as SMS to connect with them. It is for these reasons therefore it is imperative to give a closer eye to SMS-based systems.

2. Methodology

The study adopted the survey of the existing SMS systems and analysis of archival information as the type of research design. Surveying existing systems helped researcher to get a real reflection of what is happening as part of understanding interactions of the existing systems. This helped to explore the strengths and weaknesses of the existing systems. On the other hand analysis of archival information based essentially on what other researchers say on the area under study. This method was mostly about learning from other people's work and using that to inform this work to further scientific knowledge (that is, it helped to see what others did, what they got wrong and how it can be taken further). For this reason therefore data collection methods were basically observations and review of existing documents as well as internet search. Collected data were then carefully analyzed and then presented as part of findings in the present paper.

3. Findings

3.1 Methods for Text Messaging Interactions

According to [10], [4] and [11] the SMS-based systems can be categorized into three kinds; those deals with one way only broadcast messages, those which deal with sending as well as receiving SMS and group based SMS chat. There are, as well, those SMS-based systems that allow sending information from multiple sources to a single destination/recipient, which are grouped into one way only. As demand for having various forums or discussion groups increase while mobility of users remains constant, it is important to look on how we can facilitate forums or discussion groups based on mobile phones SMS. The SMS based discussion groups form basis for this paper and hereby called Mobile Discussion Groups (MobDGs). The following sections discuss each of these categories of SMS-based system interactions.

3.1.1 One-Way Interactive Text Messaging

One-way interactive text messaging is concerned with broadcasting a text message from a single source to multiple SMS recipients [11]. This group does not provide avenue for SMS recipient to reply. [6] added that broadcasting messages can be used to deliver a wide range of information to mobile phone users from share prices, sports scores, weather, flight information, news headlines, lottery results, jokes, to horoscopes. According to [4] one way only SMS-based systems provide a good way of communication as it provides individuals with updated information on various events. For instance, BBC News sends breaking news SMS alerts to registered users with an estimated average of about 12 messages per month, depending on events [12]. The Reuters Market Light (RML) implemented in India is also an example of one way SMS-based system. The RML functions by sending SMS to subscribed farmers with information on prices, weather forecasts, crop advice, and general news item. The information is automatically broadcasted to farmers after subscription [13].

3.1.2 Two-Way Interactive Text Messaging

[10] and [11] consider this type of SMS-based system as one kind of person-to-person Messaging because it involves sending and receiving SMS between one individual and another. Two ways system text messaging is the most commonly used SMS application and it is what the SMS technology was originally designed for. In these kinds of text messaging applications, a mobile user types an SMS text message using the keypad of his/her mobile phone, then he/she inputs the mobile phone number of the recipient and clicks or press a certain option on the screen, such as “Send” or “OK”, to send the text message out. The recipient of the message can also reply back the received SMS and conversation continues. In the words of [4] this kind of interaction have been powerful way of communication as it cheaper, does not require recipient to be available online for a message to be sent (if a recipient is offline a message will be sent and remain pending until when becomes online then the message will be automatically delivered), enhances privacy of the two conversing, and also messages (inbox and outbox) are automatically stored on the phone until when the conversing persons find it necessary to delete them.

3.1.3 Group-based SMS Chat

Group-based SMS chat application is another kind of person-to-person text messaging application that allows a group of people to exchange SMS text messages interactively [11]. [5] contends that in a chat application, all SMS text messages sent and received are displayed on the mobile phone's screen in order of date and time. SMS text messages written by different mobile users may be displayed in different colors for better readability. In the same way as Internet chat groups have proven a very popular application of the

Internet, groups of likeminded people, so called communities of interest, have begun to use SMS as a means to chat and communicate. SMS-based chat services are an emerging application area [13]. Because SMS chat applications are high volume applications whereby one message submission leads to multiple message deliveries, we should expect this application to be a significant generator of short messages in the future.

There are many different systems that provide group-based SMS chat. One example is MobileHookup, an SMS chat service that help young people to meet each other. Another example is Frontline SMS, an interoperable technology that works anywhere there is a mobile signal, and it is incredibly accessible to rural individuals because it does not need the Internet to function. Once an individual or an NGO has downloaded the software onto their computer, they can send and receive messages to and from as many people as desired, all via text message. For individuals on the ground in these developing regions, technologies like FrontlineSMS can help them communicate with both local and global networks and build their social capital via mobile connections [16]. Mobile Instant Messaging such MxIT also falls under umbrella term *Group-based SMS chat*, since it is text-based, bi-directionally exchanged, and happens in real-time. It also works for mobile devices such as PDAs and cell phones [14]. According to [15] MxIT is a synchronous communication tool that works for mobile devices such as PDAs and cell phones, it is network-independent i.e. it can operate between interactants on any network provider and the interactants do not have to be on the same network. Other examples of group-based SMS chat as presented by [17] are MyToday MOB, MyTodayChat, and SMSGupShup.

3.2 Weaknesses of the Existing SMS-Based Systems

3.2.1 One-Way Interactive Text Messaging

One way only SMS-based systems have not survived without being criticized. [11] contends that once users have familiarized themselves with reading and sending short messages, they often find that SMS is a useful way of exchanging information and keeping in touch with friends. This is particularly so when the recipient is also able to reply to messages for two-way communication. If the recipient of the short message is unable to read or reply to it, then clearly the effectiveness of using SMS as the communications media is much lower. Therefore the inability of these SMS systems to support two-ways communication is regarded as the weakness.

3.2.2 Two-ways interactive text messaging

Despite the positive features of the SMS systems providing two-ways interactive message as presented by [4], but [13] pointed out that there has been an increasing demand for groups of people, especially youth, to use their phones for SMS chats which are basically not supported by these two ways SMS-based systems. The lack of group SMS chatting feature in this type of text messaging interactivity is its main weak point.

3.2.3 Group-based SMS Chat

Literature presents different weaknesses of the different systems facilitating group based SMS chat. [17] for example, mentioned the negative point of MobileHookup as requirement for users to use computer to create their own personalized site on mobile hookup. [14] pointed out that MxIT runs only on GPRS/3G mobile phones with java support. This is the weak point of MxIT as we need to have SMS based systems that support interactions to almost all types of SMS enabled mobile phones. The weakness of SMSGupShup is the requirement for every user to sign up on the web interface to be able to send SMS to the group. Other identified weaknesses of the existing systems for SMS chat are limitation of SMS per day and limited number of members in the chat room, for instance MyTodayMOB

allows only five text messages per day while MyTodayChat limit members in a chat room to only 25 [17]. Table 1 presents a summary of negative points of these group-based SMS chat.

Table 1: Examples of Group-based SMS Systems

Group SMS System	**Negative Points**	**System URL**
MxIT	runs on GPRS/3G mobile phones with java support	http://site.mxit.com/
SMSGupShup	everyone need to sign up on the web interface to be able to send SMS to the group	http://gupshup.me/
MyToday MOB	5 text messages per day per number	http://mytoday.com/
MyTodayChat	The limit is 25 members per chat room	http://www.orkut.com/
FrontlineSMS	Requires users to download required software onto their computer for them to use the system	http://www.frontlinesms.com/
MobileHookup	Users have to use the computer to create their own personalized site on mobile hookup	http://www.mobilehook-up.com/

Group SMS chat is a most needed feature which youth demands very badly. However we currently lack in such a service which is up to the satisfaction of all users [17]. Practically SMS chat as it is with internet chat occurs in real time, there is no message moderator where people are more likely to state opinions than factual data, and they are non subject specific kind of communication. It is imperative to design an SMS based system that facilitate group communication but at the same time taking into consideration the factors presented.

3.3 Suggested Improvements

We suggest the implementation of Mobile Discussion Group (MobDG) as a solution for improvement of the identified challenges. A MobDG is computer application accessed through phone SMS technology dedicated to the sharing or exchange of messages between groups of system users on a network. MobDG offers more accessible and cost effective solution towards information dispense. MobDG can have some similarities with SMS chat as they all involve groups of SMS users. However MobGDs differ from SMS chat in the sense that messages in these systems are at least temporarily archived. Also, depending on the access level of a user or the forum set-up, a posted message might need to be approved by a moderator before it becomes visible. MobDGs are subject-specific forums. Users join or subscribe to groups that discuss issues that are relevant to them personally or professionally. All groups have a list manager who controls the subscriber list. Some groups may have a moderator controlling the flow and direction of topics within the group.

3.3.1 MobDG Interactions

Figure 2 illustrates a conceptual design of how interactions between systems subscribed users take place in a MobDG system for a particular topic or subject. As it can be seen in the figure MobDGs require a moderator to filter all received SMS before they get accessible to the group members. This feature make MobDG a bit different from other SMS chat

groups because according to [17] SMS chat groups have no message filtering feature. All received and filtered SMS are stored on a database for future archival.

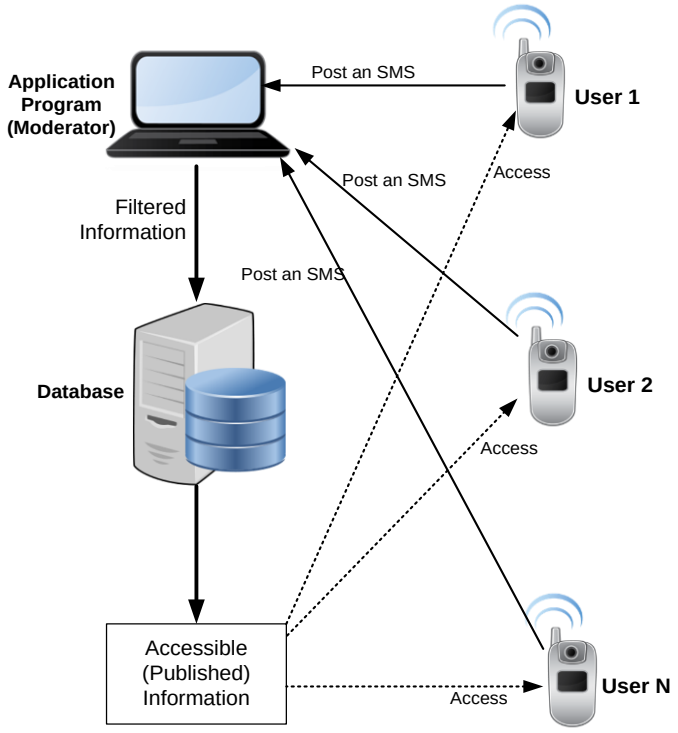

Figure 2: MobDG System mutual interactions

3.3.2 *User Subscription and Un-Subscription to MobDG*

In order to have control of users using the MobDG, each user wishing to use the system will not just start using it, he/she will be required to subscribe to the system. To subscribe the user will be required to send requesting message (using a certain format) to the MobDG administrator requesting to be added to the subscriber database. The administrator then add the user to the group and send him/her a confirmation message with information about how to send messages to the list, as well as information about unsubscribing. At the time the user subscribes, he/she often also receives the MobDG's statement of purpose or philosophy, along with posting guidelines and suggestions. Figure 3 illustrates how this subscription process takes place.

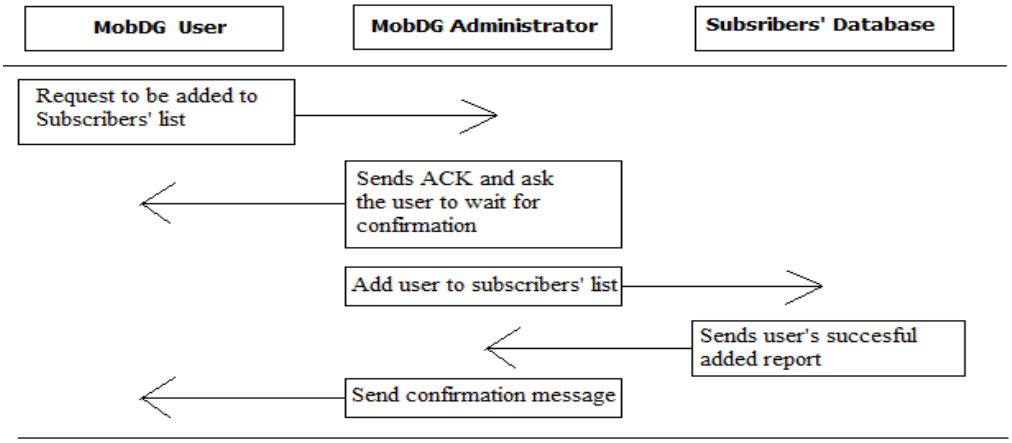

Figure 3: MobDG Subscription process

Subscribed users will be capable of participating in the discussion groups. When a user want to un-subscribe from the group he/she will be required to use the same procedures used during subscription.

3.4 MobDG Considerable Features

3.4.1 Usability

MobDG is based entirely on phone SMS and therefore any SMS enabled mobile phone should be capable of participating. With MobDG it is not necessary to use multimedia enabled mobile phone or to be run on GPRS or 3G. Also to be able to use the system it should not be necessary to download special software for the system to work. Subscription and un-subscription should be done through users' mobile phones and therefore there is no need to login to the internet for that reason. MobDG topics presented support unlimited number of users.

3.4.2 Security

SMS is a store-and-forward messaging system for cell phones. It was clearly not designed with security in mind. An SMS-based authentication system is therefore very vulnerable to security threats, one of which is a man-in-the-middle attack [16]. Although man-in-the-middle attack may not seen as a serious threat to SMS-based systems as system attackers have no much interest on the system but it is good to put forward preventive measures. MobDG System should use certificate chaining to thwart a man-in-the-middle attack. To enhance security of the system all MobDG communications have to be asymmetrically encrypted to assure a valid client (mobile phone user) talks only to a valid server.

3.4.3 Privacy

[3] pointed out that as you build a database of messages both sent to users and received; consider the potentially sensitive nature of the data you are collecting. Health information or reports of human rights abuses, for example, can be very personal and cause distress or danger if fallen into the wrong hands. MobDG have to use moderator who filters all SMS posted to the system to ensure privacy and security of some information.

3.4.4 Verification

According to [16] one of the challenges of a crowdsourcing tool or indeed any platform that relies on citizen reporting is the issue of verification. It is hard to tell whether information received is reliable or not. When it deemed necessary for to verify information MobDG moderator will serve the purpose.

4. Conclusion

This paper presented a survey of various SMS-based systems and their different text messaging interaction methods. A literature survey on them revealed different weaknesses associated with each of those text messaging interaction methods as clearly stipulated in the document. The turning point to those weaknesses, as presented in the paper, is to design a more user friendly group-based SMS system for phone SMS users, called Mobile Discussion Group (MobDG). Theoretically a MobDG can sound to be similar with the existing SMS chat systems as they all involve groups of SMS users, but it differs from them in the sense that it will be used in any SMS enabled mobile phone, it should have unlimited number of SMS per day and unlimited number of members in the group, and messages in a MobDG have to be at least temporarily archived. Also, depending on the access level of a user or the forum set-up, a posted message might need to be approved by a moderator before it becomes visible. Also, to make it different from SMS chat, a MobDG have to consider the following essential features; usability, security, privacy and verification as described in the document.

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