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Content Presentation and SMS-based e-Government

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An SMS-based e-government model has been previously proposed as appropriate for delivering e-government services in developing countries. SMS has two main limitations: a limited number of characters per message and a command-line interface. In this paper we focus on how to overcome these two major constraints in order to optimize the usage of SMS in e-government services. We propose that the problem of a limited number of characters per message be addressed by using loss less or lossy SMS compression technology combined with the use of abbreviations and emoticons. To achieve an easy to use interactive SMS-based system for data exchange the SIM Application Toolkit is recommended.

1. Introduction

In a previous paper it has been argued by the authors that the Short Message Service (SMS) of mobile phones can be used to address the problem of low citizen participation in e-government in developing countries (12). Compared to the Internet, SMS messaging is used by many more people, there is a much more extensive infrastructure and it is much cheaper. Therefore, Susanto (13) proposed an SMS-based e-government model for delivering e-government services in developing countries.

However, there are two major challenges to the use of SMS technology for delivering e-government services. The first challenge is how to optimize the limited medium of SMS in order to deliver the complex information in e-government systems. Each SMS message must be no longer than 160 alphanumeric characters and contain no images, graphics or sounds. This is a significant problem in using SMS technology for e-government since it limits the amount of information that can be sent or received per message. Additionally, messages cannot deliver non-verbal information such as the emotions, situational, and the environmental context. These are important in communication since a receiver tends to interpret the intentions of a sender from the non-verbal cues received. The absence of non-verbal cues makes it difficult for a receiver to interpret a message correctly (3).

The second challenge is how to optimize SMS technology for data exchange. The SMS interface is comparable to a command line interface, it is text-only and one-dimensional with no menus, forms or buttons to help the user make choices or understand and remember its affordance (what the system is capable of and the types of input it will accept) (11).

This paper focuses on assessing various strategies to address the two limitations of SMS technology for delivering e-government services. (Other challenges for an SMS-based e-government model such as security issues will be investigated separately in another paper.)

2. Presenting information using SMS technology

The first challenge for presenting information relates to the limited number of characters per SMS message. One SMS message has maximum of 160 characters and is text only. Images, graphics or sounds cannot be sent. This limitation makes it difficult for senders (local authorities) when they want to send complex information which needs more than 160 characters with images, graphics or sounds to receivers (citizens). It will also contribute to misunderstandings when the complex information message is read. Ideas for overcoming this challenge include breaking down complex information into concise sentences, using abbreviations, using emoticons and deploying SMS compression methods. (It could be argued that initially only short simple messages should be sent by SMS.)

2.1. Breaking down complex information

Considering the 160 character restriction of SMS technology, longer messages should be broken down into short, concise sentences using easy-to-understand words without changing the content. However, breaking down the messages into several smaller messages has two drawbacks. It is costlier and there is no guarantee that the messages will arrive in the order they are sent. To address the second problem, Schusteritsch (11) recommended putting a number on each message using the format "1 of 2" which help users to understand that the information is being delivered by more than one message and the order of the messages.

2.2. Using abbreviations

Using abbreviations is another method that can be used to address the problem of a limited number of characters in each SMS message. This technique has the advantage of reducing the number of characters to be typed. There are five methods for generating shortened words in SMS:

- using traditional (known) or ad-hoc abbreviations (such as *spose* for suppose, *mins* for minutes);
- dropping a single letter (such as *ritten* for written);
- using letters, symbols or numbers to make the appropriate phonetic sound (such as *fone* for phone, *th@s* for that's, *gr8* for great);

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- using standard or ad-hoc acronyms (such as *w* for with, *PWB* for please write back); or
- using hybrid methods (such as *b4* for before which is a letter drop and number sound, *thanQ* for thank you which is letter drop and letter sound) (11).

Even abbreviations that are relatively easy for a person to understand are potentially difficult for an automated service to interpret. Consequently, if the SMS-based e-government system will accept abbreviated messages, the local authority should standardize and document all abbreviations used in the system. The list of standard abbreviations should be made known to citizens.

2.3. Using emoticons

An emoticon is worth a thousand words. Emoticons are another form of SMS shorthand (often used in e-mail) for adding the emotional context of the message. The use of emoticons can reduce the number of characters significantly and express the emotional context of the message appropriately (6).

For example, when the local authority sends a citizen good news, the message can start with a smiley tag :) or when the government sends a reminder about overdue accounts, a disappointed tag :-e ; sad tag :(for regretful message or shouting tag :-V for warning message can be added. Research by Amin (3) proved that conveying the emotions by enhancing text messages with human embodiment, which can be symbolized by emoticons, can result in a more pleasant experience for both the sender and receiver as well as often contributing to the understanding of text messages.

Various types of emoticons have been collected in electronic dictionaries such as the one at <http://www.computeruser.com/resources/dictionary/emoticons.html>. However emoticons are not familiar to every person. As with abbreviations, local authorities who want to use emoticons in their messages should standardize and publicize their message emoticons.

2.4. SMS compression technology

SMS compression enables information of more than 160 characters to be sent within a single short message. The method has been defined and incorporated in the GSM-SMS standards. This technology can be put in place to address the limitation of number of characters in an SMS-based e-government model. There are a number of SMS compression techniques that have been widely used.

One of the compression methods removes all prepositions, punctuation and spaces (every word starts with a capital letter), and replaces long words with abbreviations (such as information=info, you=U, four=4, or for=4) in the message. All words start with capital to make it clear there is a missing space. This system is capable of compressing text by up to 50%. It is used to compress the text of email messages when they are forwarded to users' phones via SMS (7). An example of a compressed message as displayed in Figure 1.

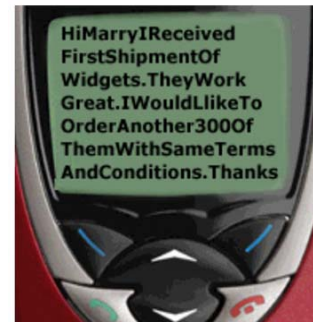


Figure 1. A compressed message (iPiPi.com [7]).

Another similar compression technique provides options for the compression level such as none, low, medium, high, or custom. For custom, users can create their own SMS dictionary by editing the dictionary file (8). For example in the MobiSMS system, typing the following message:

Hi Sally, please phone me if you can meet for lunch at one today. Thanks Robert.

when sent with medium level compression will be seen on the user's phone as

Hi Sally, pls phone me if u can meet 4 lunch @ 1 2 day. Thx Robert.

Other compression methods use a lossless compression algorithm (such as the Deflate algorithm) which compress the sent message and decompress the incoming message without deleting characters (all the written characters will be received). An example of this application is *SMS Compression* by WiBits, which can produce a message divided into two messages from an original message composed of three messages (33.3% reduction) or a single message from an original message consisting of two messages (50% reduction) (10). Another program *smsZipper* patented by Aalborg University, enables compression by factors of two to three and supports different languages such as (English/German/Italian/Danish) (9). To send and read a compressed message the sender and the recipient need to install the application.

To address the limited number of characters in an SMS message, we suggest deploying a lossless compression method combined with abbreviations and emoticons. Breaking down complex information into simple short sentences should be a key principle when a local authority intends to send information to citizens via SMS technology.

However, before implementing a lossless compression algorithm SMS compression enabled phones (such as MIDP 2.0 phones or CLDC 1.0/1.1 phones with at least 500Kb of free memory) should be widely used by citizens (1). The local authority should provide an affordable application, promote it and make sure as many as people have installed the application on their phones. If this situation is not achievable, the local authority can use a lossy compression method (which removes all prepositions, punctuation and spaces as well as replacing long words with abbreviations combined

with emoticons. This method doesn't require citizens to have enhanced phones; it just needs the local authority to develop the server system and to encourage as many as citizens to sign up. The usage of abbreviations and emoticons in a message will not only shorten the message but will also convey the emotional context appropriately.

3. Limitations of the SMS interface

The limitations of the SMS interface become important when the technology is used for data exchange such as filling out a form or sending some personal data by SMS. As the SMS interface has no menus, forms or buttons, the user has limited information about the system's affordance. They will not know what the system can do or what sort of input it will accept. They may input incorrect data or use an incorrect format. Developing an easy to use interactive interface for the SMS-based system and deploying a SIM application toolkit are recommended to address this challenge.

3.1. Developing an easy to use interactive interface

An easy system means the system should be easy to understand and to use by people. In particular the text format for requesting a service should be simple (not too long or complex), represent the service, be easy to remember and be similar for all services. For example, the format for requesting a tax calculation can be defined as "TAX-year-TFN" (such as TAX-2006-824644852) and for electricity bill as "ELECTRICITY-month and year-costumer's account number" (such as ELECTRICITY-062006-8556557011). We suggest that the SMS-based e-government team publishes the standard formats for requesting each service by developing a wallet-sized instruction card that can be distributed to potential users. It should also be possible to download and print screen shots of example query messages and results. Additionally, the system can also provide simple-answer options when the service requires some data for completing the transaction, such as "type A for income<\$100, B for \$100-\$500, C for >\$500", which is similar to menus or radio button options in a form. To promote a clearer conceptual understanding of SMS-based e-government services before the user's first interaction with the service, printed information and a telephone hotline service should be provided. These supporting information systems will encourage citizens to use the services by helping them to understand the general concept of the system, the ease of use and the benefits of using the services.

When used as an interactive system, an SMS-based e-government system should have the capability to send feedback for any request from a user. Some users may start sending messages without ever seeing any support publications. If the system cannot understand a message it should request the user to send the message "help". At the help response, the service should return a concise set of instructions on how to use the system and highlight the most important features of the service. Alternatively the system could send a concise set of instructions when it does not understand a message without requiring the help request.

If part of the query message is misspelt or in the wrong in format, the service should have the capability to interpret the message to the closest match that the service provides and return a help message explaining how to execute the service. For example, sending the query "tax" could return a message telling users how to ask about their tax and how to pay tax via SMS.

3.2. Deploying the SIM Application Toolkit

Another way of addressing the limitations of the interface for data exchange is to use the SIM Application Toolkit (SAT). The deployment of this standardized protocol will make easier for users to access and to reply to services through custom menus on the phone and reduce the possibility of incorrectly formatted or incorrect data being sent by users. Users will feel more comfortable making selections from a menu rather than pressing each character and sending the full text. It led to a 10-15% increase in total SMS volumes (2) and should increase the use of SMS-based e-government systems.

Deploying the SAT will provide a tool for accessing the SIM that contains information about the end user allowing security-related functions and identity verification to be implemented.

Technically the SAT is designed as a client-server application. On the server side, SimCard platform specialists such as Orga, Gemplus and AU-System have introduced servers based on the Global System for Mobiles (GSM) standard. On the client side, phone manufacturers such as Siemens, Sagem, Bosch, Nokia, Ericsson and Alcatel have launched phones that have SAT support (5). SAT is programmed into the special GSM SIM card enabling the SIM card to drive the GSM handset interface and build an interactive exchange between a network application (in the server) and the end user as well as to access and control access to the network (4).

An example of using SMS and SAT for transactions is the MobilSmart application launched by Telia (Sweden's number 1 Telecom Operator) and Postgirot Bank (a subsidiary of Sweden Post). This application assists customers throughout transactions when paying electricity bills. A specific PIN code must be entered in the GSM phone to start the application. Then, on the displayed menu, users enter their Postgirot account number, the date and the amount payable; they can also add a comment to recognize the payment on a future statement. After entering all the required information, the user sends the data. The SIM will calculate an electronic signature using a dedicated algorithm and package all the information into an SMS sent to Telia's Short Message Service Center (SMSC). The information is then processed by Postgirot's SmartSec system. Once it has been processed, SmartSec returns an acknowledgement to the user to confirm the payment (4).

SAT seems to be an ideal means for delivering all SMS-based e-government services once local authorities

have setup the servers systems and SAT is installed and enabled on citizens' phones.

3. Conclusions

In this paper we have discussed a variety of strategies to overcome the limitations of SMS technology for delivering e-government services. The limitations include the limited number of characters in each SMS message and the command-line like interface.

To address the limited number of characters in each SMS message, complex information needs to be broken down into concise sentences before being sent. When compression enabled phones are in widespread use, loss less SMS compression technology can be used to send more information per message. This compression system can be combined with abbreviations and emoticons in the message to express the emotional message. Alternatively lossy compression methods which remove all prepositions, punctuation and spaces as well as abbreviating long words and emoticons can be used.

Finally SAT seems an ideal way of achieving an easy to use interactive system that addresses the limitations of the SMS interface for data exchange.

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