Transference of Compressed Audio through SMS Using Prediction by Partial Matching Technique

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Abstract

This paper presents a method to transfer voice message through SMS in GSM network with and without using compression technique and then their results are compared. Generally, SMS is not used to transfer voice because it doesn't have high bandwidth data service like GPRS, EDGE, and HSDPA. In this paper two approaches are used to transfer voice through SMS. Firstly, voice message is transferred without using compression technique, Secondly; Prediction by Partial Matching (PPM) technique is used to compress payload text of SMS. Major functionality of the algorithm is to convert voice message in to characters, than apply compression method on those characters. Finally, set those compressed characters as a payload text of SMS, and transmit it over GSM Network. For testing the proposed method an application is developed using J2ME language. We test our application on Nokia N95 with different voice messages up to 360 times.

Keywords: *GSM (Global System for Mobile Communications), SMS (Short Message Service), Prediction by partial matching (PPM) Compression, Voice Messages*

1. Introduction

Generally, SMS is text (alphanumeric or binary non-text) based service and cannot send sounds, images and animations etc, but still it is widely supported by other technologies and has national and international roaming facilities [1]. Other messaging services such as EMS (Extended Messaging Service) and MMS (Multimedia Messaging Service) have richer contents than SMS. EMS can send predefined sounds, images and animations but have one major drawback that it is not widely supported like SMS; its content information is present in message header which will be ignored in unsupported mobile phones. In MMS, one can transfer sounds, videos, images and animations etc., but it need higher network support such as 3G for delivering long messages (up to 1000bytes) [2]. Issues related to MMS service are; new billing structure, up gradation in network and device compatibility etc.[3]. Solutions to these issues and widely available GSM-SMS structure give birth to new areas (thoughts) which majorly focus on the utilization of SMS technology as a transferring medium i.e. [5-7, 9] etc.

In this paper our major focus is to enhance voice transferring [7] method by introducing PPM compression technique in it. PPM is an adaptive statistical data compression technique based on context modeling and prediction. PPM model use a set of previous symbols in the uncompressed symbol stream to predict the next symbol in the stream [4]. Utilization of PPM with the said method performs well and produced better results. Paper distribution is as

follows; Section 2 describes the related work, section 3 is about the proposed methodology, section 4 discusses the results and finally we conclude the paper.

2. Related Work

[5] Presents the voice transfer through SMS over GSM network. Their method takes utterance as input. Utterance is generally generated by the encoder card present in all mobile phones. After getting input they convert it into non text representation, which used as a payload text of SMS. Major reason behind this is that; SMS is text based service. And it can only transfer alphanumeric or binary non-text. [6] Discuss the method of creating and displaying animations on a mobile device using SMS service. Device needs user input on which SMS is constructed. Then it sets the animation flag after receiving the input; flag determine whether the SMS have animation characteristic or not. Such SMS text is parsed at receiver end and all the animation characteristics is displayed. [7] discuss the voice transferring through SMS. In this method authors convert the voice message into the payload text of SMS. [8] presents Prediction by Partial Approximate Matching (PPAM); a method of compression and context modeling for images. PPAM models the probability of the encoding symbol based on its previous contexts, whereby context occurrences are considered in an approximate manner. It shows a particularly superior performance when compressing images that have common features, such as biomedical images. [10-11] discusses the application of PPM algorithm. [10] is about XMLPPM, a streaming compressor based on the technique known as Multiplexed Hierarchal Modeling (MHM). [11] discuss the different variations of PPM compression method and the author noticed that PPM algorithm yields the best compression rates but their time and space complexities are high.

3. Proposed Methodology

In this paper, firstly the voice message is sent through SMS without compression. For this purpose we used the same algorithm presented in [7]. Steps involved to convert voice message in to SMS are as follows:

- Store user input (voice message) in a ByteArrayOutputStream.
- Convert the signed ByteArrayOutputStream into unsigned integer array.
- Convert unsigned integer array into their respective Extended ASCII characters, but before that conversion, 256 was added in all unsigned integer array values which was ranged between 0-31 in order to move them up to the range of 256-287. The main reason behind this is that, values of 0-31 of ASCII characters cannot be send through SMS as such characters are universally reserved for specific functions; e.g. ‘0’ represents ‘null’ in ASCII etc.
- Extended ASCII characters are then converted into strings and those strings are used as a payload of text of SMS.

When such SMS is received at receiver side, application perform same steps but in a reverse order. In above mention procedure concatenated SMS are used. To record the order of concatenated SMS produced by the sending device, first three characters of SMS are reserved. This produced 0-999 indexing values for concatenated SMS. The

major issue with this approach is high number of SMS. This problem can be solved through compression method.

In the next phase, we incorporate PPM algorithm within that method. PPM is applied on Extended ASCII characters, so as to achieve smaller number of characters which ultimately reduce the number of concatenated SMS. First three steps involved in this approach are same as above. One additional step is added in the above algorithm that is PPM compression.

- Apply PPM lossless compression algorithm on Extended ASCII characters and convert ASCII characters into the strings and set those strings as a payload text of SMS.

In this case, when SMS received at receiver side; application buffered the payload text of all SMS as a single record. Decompress the extended ASCII characters than apply all three steps in reverse order to get actual voice message. Figure 1 shows the proposed methodology working with the existing GSM-SMS architecture. Application was only installed in mobile phone; no further change in existing architecture was required.

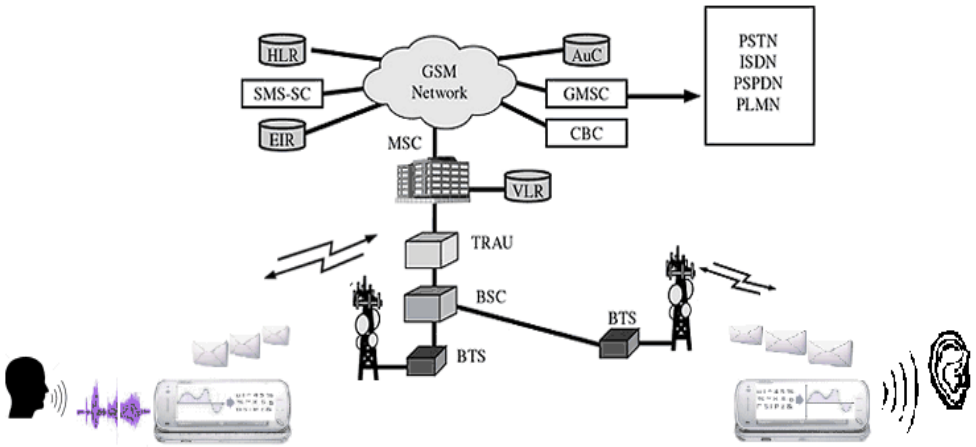

Figure 1. Interaction of Proposed Methodology with existing GSM-SMS Architecture

4. Results and Discussions

For real time results we developed an application using J2ME platform and installed it on "Nokia N95" for testing. During experiments our major focus on two factors; number of characters and number of concatenated SMS. Three different formats for experiments are used; AMR (Adaptive Multi-Rate), PCM (Pulse-Code Modulation) and ULAW. More than 360 tests with different voice messages are conducted. Here, we considered two cases; with and without compression. "WPPMC" Represents "With PPM Compression" and "WOC" Represents "Without Compression".

Figure 2a and 2b show the AMR results for both cases. In figure 2a, Blue line shows the number of characters produced by AMR in case of sending voice message through SMS without compression. Red line is about AMR results with compression. The graph is evident about the usage of compression algorithm that it works very well. Similarly, figure 2b shows that with compression algorithm our technique produced less concatenated SMS for AMR format. The overall enhancement for AMR format is 30% and above.

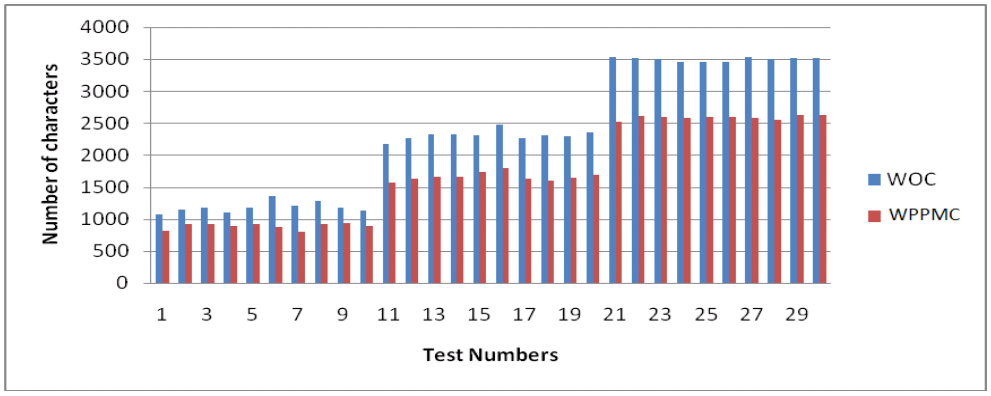

Figure 2a. Number of Characters for AMR Format

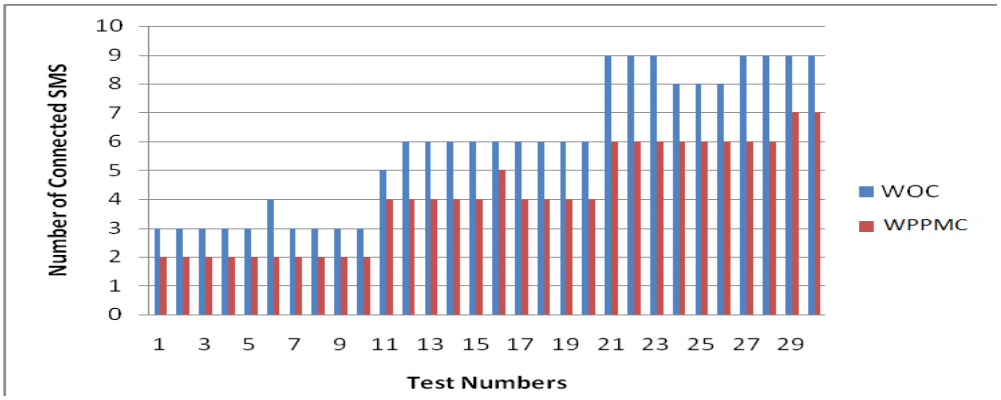

Figure 2b. Number of Connected SMS for AMR Format

Figure 3a and 3b shows the results of PCM format for both cases. Figure 3a is about the number of characters produced for PCM format and figure 3b shows the results of concatenated SMS. Results clearly show that method of sending voice message through SMS using PPM produced small number of characters and SMS for PCM format. Overall enhancement for PCM format is 50% and above.

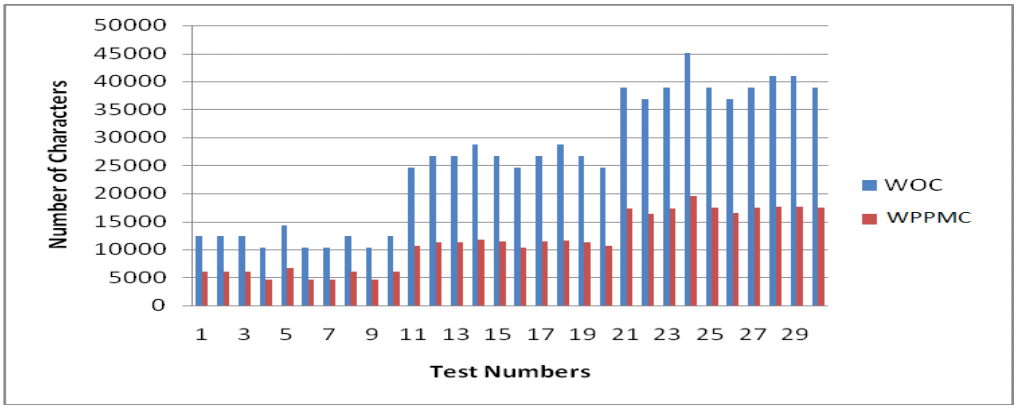

Figure 3a. Number of Characters for PCM Format

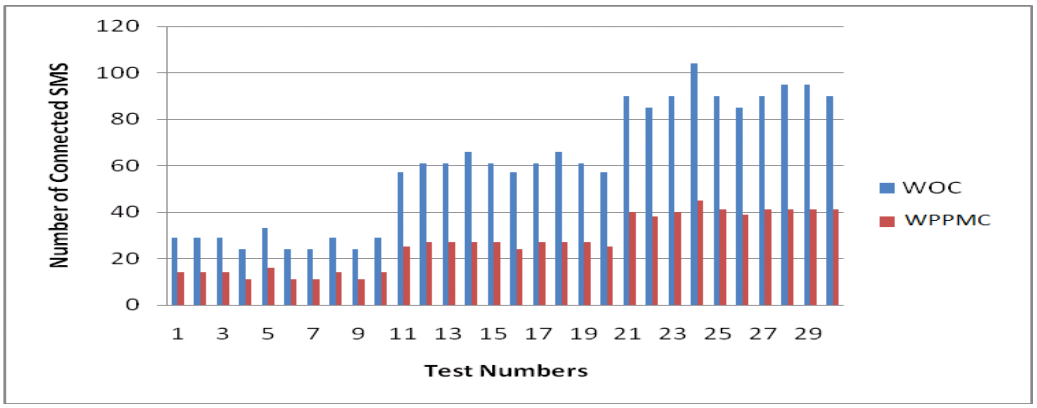

Figure 3b. Number of Concatenated SMS for PCM Format

Figure 4a and 4b is about the ULAW results for both cases. It was found that method with compression technique worked well and produced smaller number of characters and concatenated SMS for ULAW. A graph represents that PPM produce small number of SMS with the ratio of 50% or above

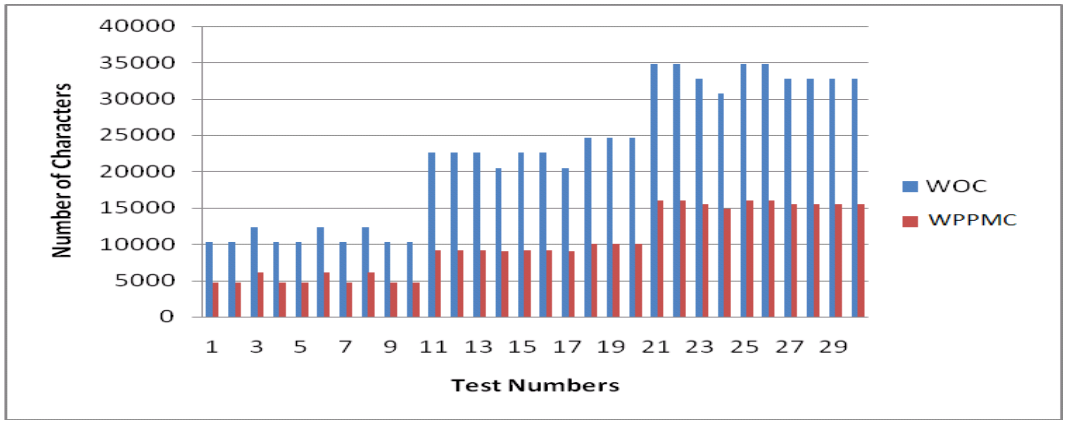

Figure 4a. Number of Characters for ULAW Format

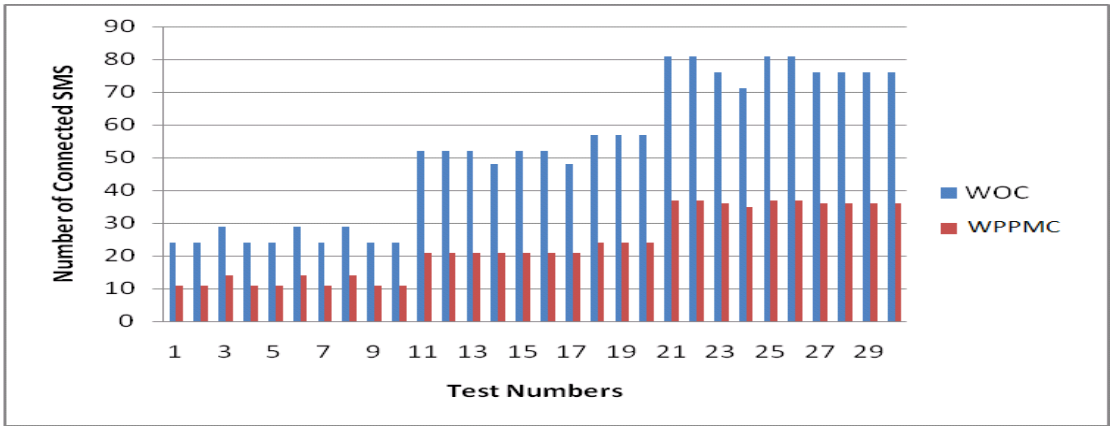

Figure 4b. Number of Concatenated SMS for ULAW Format

5. Conclusion

GSM network uses SMS service to send text. SMS service cannot send other multimedia services like Voice, Image and Video. Different approaches were developed which use SMS for transmitting voice. In this paper we enhance the voice transferring method through SMS by using PPM compression technique. We also compare the results of both cases; with and without compression. In recently presented method it was observed that transferring voice message without using compression technique produce large number of concatenated SMS. This issue is solved with the compression method. Results clearly identified that PPM compression technique reduce the number of connected SMS with the average ratio of 30%, 50% and 50% for AMR, PCM, ULAM respectively.

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