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Image Encoding to Short/Text Message

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ABSTRACT

Sending an image using Short Message (SM) is the purpose of this article. An image contains a large information and existing base character such us American Standard Code for Information Interchange (ASCII) are not enough for encoding, then we are obliged to create a new base. The short message will go through mobile telecom network. The sender uploads the image, the algorithm process on its turn to convert the input to short message and the receiver receives a binary photo by decoding the message received. This encoding, decoding methods are not limited for Person to Person (P2P) service but applicable also in case of bulk message Application to Person (A2P) and Person to Application (P2A). The only condition required is that each user (person or application) knows the method of encoding and decoding. It means also that image encoded is supported by the standard protocol Short Message Peer-to-Peer Protocol (SMPP). A simple image can be sent with one short message which is less than 160 characters however for complex image, it may be more than one short message. The research written on this paper can bypass the usage of Multimedia Messaging Service (MMS) because a Short Message Service Center (SMSC) can do its job in condition that the mobile operator has the application installed on Subscriber Identity/Identification Mobile (SIM) card or in software provided which can be downloaded by subscriber.

KEYWORD: *Short Message, encoding, decoding, short message service center, short message peer-to-peer protocol, multimedia messaging service*

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I. INTRODUCTION

Short Message Service (SMS) is most popular in Madagascar comparing with Multimedia Message Service (MMS). MMS is never attracting more subscribers then the existing telecom mobile network operator (MNO) didn't invest. It is possible to send an image with social networks but internet connection is mandatory. So image to text message encoding is a solution in the aim of using SMSC as transit platform. MNO doesn't know the meaning of sent SM, it means that the algorithm that we propose here can be used in encryption domain.

To understand well the content of this paper, we start with general overview of SMSC and MMSC. Then, we continue with algorithm presentation and testing followed by conclusion.

II. Short message service

SMS appeared on the wireless scene in 1991 in Europe. The European standard for digital wireless, now known as the Global System for Mobile Communications (GSM), included short messaging services from the outset.

In North America, SMS was made available initially on digital wireless networks built by early pioneers such as BellSouth Mobility, PrimeCo, and Nextel, among others. These digital wireless networks are based on GSM, code division multiple access (CDMA), and time division multiple access (TDMA) standards.

Network consolidation from mergers and acquisitions has resulted in large wireless networks having nationwide or international coverage and sometimes supporting more than one wireless technology. This new class of service provider demands network-grade products that can easily provide a uniform solution, enable ease of operation and administration, and accommodate existing subscriber capacity, message throughput, future growth, and services reliably. Short messaging service center (SMSC) solutions based on an intelligent network (IN) approach are well suited to satisfy these requirements, while adding all the benefits of IN implementations.

SMS provides a mechanism for transmitting short messages to and from wireless devices. The service makes use of an SMSC, which acts as a store-and-forward system for short messages. The wireless network provides the mechanisms required to find the destination station(s) and transports short messages between the SMSCs and wireless stations. In contrast to other existing text-message transmission services such as alphanumeric paging, the service elements are designed to provide guaranteed delivery of text messages to the destination. Additionally, SMS supports several input mechanisms that allow interconnection with different message sources and destinations.

A distinguishing characteristic of the service is that an active mobile handset is able to receive or submit a short message at any time, independent of whether a voice or data call is in progress (in some implementations, this may depend on the

MSC or SMSC capabilities). SMS also guarantees delivery of the short message by the network. Temporary failures due to unavailable receiving stations are identified, and the short message is stored in the SMSC until the destination device becomes available.

SMS is characterized by out-of-band packet delivery and low-bandwidth message transfer, which results in a highly efficient means for transmitting short bursts of data. Initial applications of SMS focused on eliminating alphanumeric pagers by permitting two-way general-purpose messaging and notification services, primarily for voice mail. As technology and networks evolved, a variety of services have been introduced, including e-mail, fax, and paging integration, interactive banking, information services such as stock quotes, and integration with Internet-based applications. Wireless data applications include downloading of subscriber identity module (SIM) cards for activation, debit, profile-editing purposes, wireless points of sale (POSs), and other field-service applications such as automatic meter reading, remote sensing, and location-based services. Additionally, integration with the Internet spurred the development of Web-based messaging and other interactive applications such as instant messaging, gaming, and chatting [1].

III. Multimedia messaging service

Multimedia Messaging Service (MMS) is an evolution of (SMS), extending the text content with capabilities to transmit multimedia messages to other mobile users. The messages can be any combination of images, animations, audio (voice, music), video and text. MMS supports most common compression techniques, such as JPEG and GIF for pictures, MPEG-4 for video and MP3, WAV and midi for audio.

MMS is a store and forward messaging service. This means that if the recipient phone is not switched on, the message will be stored in the network and sent to the recipient as soon as the phone is switched on. Different protocols can be used as MMS transport mechanism, such as Wireless Application Protocol (WAP), HTTP or Session Initiation Protocol (SIP). The most common approach used nowadays is WAP. The subscriber will need an MMS-enabled phone [2].

IV. Algorithm

The algorithm is divided in three parts: preparation, encoding image to short message and the inverse.

A. Preparation phase

Step 1 : Load original image I.

Step 2 : Convert I to binary image I_B.

Step 3 : Resize I_B to obtain I_R. This step can be ignored but the short message length will be long.

Step 4 : Split I_R to n block of 8x8 B_n.

Step 5 : Threshold B_n to minimize the number of symbol to be used. This step can be ignored also but the short message length will be long too.

B. Image encoding to short message

Step 1 : Establish a base with 257 characters shown in TABLE I to IV.

Step 2 : Concatenate first and second column of B_n and convert to decimal d_{1n}. Same case for third and fourth d_{2n}.

Step 3 : Find the value of d_{1n} and d_{2n} in column "code" of base characters and add in string array the "char" equivalent of "code".

Step 4 : Optimize the number of characters in message by adding the number of repeated characters. For example, aaaa = a4 but in case the characteris not repeated, we don't need to add 1.

Step 5 : Send the encoded short message via Telecom mobile network.

C. Short message decoding to image

Step 1 : Read the short message.

Step 2 : Insert "1" between when two characters don't have a number as separator.

Step 3 : Replace all number by repeating the character. For example, a4 = aaaa.

Step 4 : Collect two by two the characters in latest short message which present one bloc.

Step 5 : Read each character and convert the corresponding "Index" to binary. If the conversion is less than 8 bites, add 0 as prefix to reach 8.

Step 6 : Reshape conversion result of two characters to matrix B_n 8x8.

Step 7 : Form the image I_R by combining nB_n.

Step 8 : Display image.

TABLE I BASE CHARACTERS PART 1

Index	Code	Char	Index	Code	Char	Index	Code	Char	Index	Code	Char
0	120	x	21	923	Λ	41	41	)	61	61	=
1	913	A	22	955	λ	42	42	*	62	62	>
2	945	α	23	924	M	43	43	+	63	63	?
3	914	B	24	956	μ	44	44	,	64	64	@
4	946	β	25	925	N	45	45	-	65	65	Φ
5	915	Γ	26	957	ν	46	46	.	66	66	ϕ
6	947	γ	27	926	Ξ	47	47	/	67	67	X
7	916	Δ	28	958	ξ	48	960	π	68	68	χ
8	948	δ	29	927	O	49	929	P	69	69	Ψ
9	917	E	30	959	o	50	961	ρ	70	70	ψ
10	949	ε	31	928	Π	51	931	Σ	71	71	Ω
11	918	Z	32	32		52	962	ς	72	72	ω
12	950	ζ	33	33	!	53	963	σ	73	73	’
13	919	H	34	34	"	54	932	T	74	74	<
14	951	η	35	35	#	55	964	τ	75	75	>
15	920	Θ	36	36	$	56	933	Y	76	76	˅
16	952	θ	37	37	%	57	965	υ	77	77	˜
17	921	I	38	38	&	58	58	:	78	78	'
18	953	ι	39	39	'	59	59	;	79	79	¯
19	922	K	40	40	(	60	60	<	80	80	`

TABLE II BASE CHARACTERS PART 2

Index	Code	Char	Index	Code	Char	Index	Code	Char	Index	Code	Char
81	81	¸	101	101	≠	121	121	°	141	713	O
82	82	·	102	102	≡	122	122	±	142	715	P
83	83	˙	103	103	≤	123	123	{	143	719	Q
84	84	°	104	104	≥	124	124	|	144	721	R
85	85	˛	105	105	⊂	125	125	}	145	722	S
86	86	'	106	106	¡	126	126	~	146	730	T
87	87	°	107	107	¢	127	934	A	147	734	U
88	88	J	108	108	£	128	966	B	148	869	V
89	89	⊕	109	109	¤	129	935	C	149	870	W
90	90	⊗	110	110	¥	130	967	D	150	745	X
91	91	[	111	111	¦	131	936	E	151	8853	Y
92	92	\	112	112	§	132	968	F	152	8855	Z
93	93	]	113	113	¨	133	937	G	153	8764	b
94	94	^	114	114	©	134	969	H	154	8773	c
95	95	_	115	115	ª	135	704	I	155	8776	d
96	96	`	116	116	«	136	706	J	156	8800	e
97	255	ÿ	117	117	¬	137	707	K	157	8801	f
98	98	~	118	118	-	138	709	L	158	8804	g
99	99	≅	119	119	®	139	711	M	159	8805	h
100	100	≈	120	400	Ɛ	140	712	N	160	8834	i

TABLE III BASE CHARACTERS PART 3

Index	Code	Char	Index	Code	Char	Index	Code	Char	Index	Code	Char
161	161	j	181	181	µ	201	201	É	221	221	Ý
162	162	k	182	182	¶	202	202	Ê	222	222	Þ
163	163	l	183	183	·	203	203	Ë	223	223	ß
164	164	m	184	184	¸	204	204	Ì	224	224	à
165	165	n	185	185	¹	205	205	Í	225	225	á
166	166	o	186	186	º	206	206	Î	226	226	â
167	167	p	187	187	»	207	207	Ï	227	227	ã
168	168	q	188	188	¼	208	208	Ð	228	228	ä
169	169	r	189	189	½	209	209	Ñ	229	229	å
170	170	s	190	190	¾	210	210	Ò	230	230	æ
171	171	t	191	191	¿	211	211	Ó	231	231	ç
172	172	u	192	192	À	212	212	Ô	232	232	è
173	173	v	193	193	Á	213	213	Õ	233	233	é
174	174	w	194	194	Â	214	214	Ö	234	234	ê
175	175	¯	195	195	Ã	215	215	×	235	235	ë
176	176	y	196	196	Ä	216	216	Ø	236	236	ì
177	177	z	197	197	Å	217	217	Ù	237	237	í
178	178	²	198	198	Æ	218	218	Ú	238	238	î
179	179	³	199	199	Ç	219	219	Û	239	239	ï
180	180	´	200	200	È	220	220	Ü	240	240	ð

TABLE IV BASE CHARACTERS PART 4

Index	Code	Char
241	241	ñ
242	242	ò
243	243	ó
244	244	ô
245	245	õ
246	246	ö
247	247	÷
248	248	ø
249	249	ù
250	250	ú
251	251	û
252	252	ü
253	253	ý
254	254	þ
255	97	a
256	256	Ā

V. Tests and results

For experience testing, we select three images: text image, Lena photo and Baboon picture. The reason of this choice is that they don't have the same type. The results are presented in table and the first row is dedicated for preprocessing, second the conversion to short message and the last one is the text decoding to binary image.

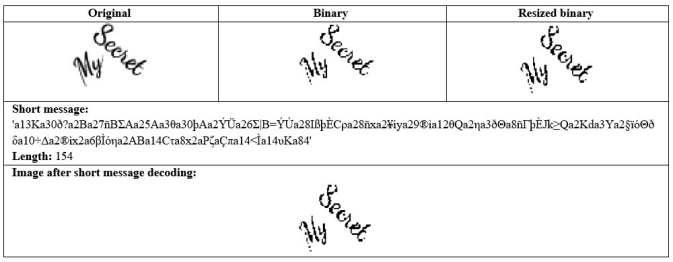

Fig.1. Experience with "text image"

This sample text message respects the standard length of one short message which should be less than 160 characters.

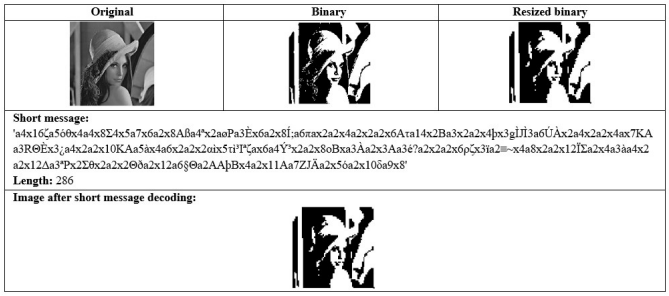

Fig.2. Experience with "Lena"

Lena image contains a lot of information and it is logic that the encoding length result is 286 characters which present two short messages.

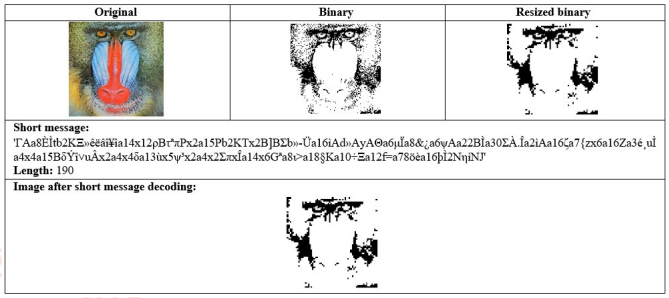

Fig.3. Experience with "Baboon"

Baboon is image color that we use to test the capacity of our algorithm. We get two short messages whose first part is 153 characters and the last part contains 37 characters.

Some SMSC equipment may have some problem to handle a specific special character and it changes with another character. Modifying few characters doesn't have visual impact on final binary image.

VI. Conclusion

Encoding image to short message is possible but message length depends on the type of image introduced as input.We presented here only the main method applied for binary image to obtain message length minimum however our algorithm can be extended with another type of image such as gray and color. We can loss same information during conversion processing from any image to binary but the pertinent information stays visible. We chose this approach because mobile network operators charge these subscribers based on short message length. One short message is limited to 160 characters and if your message length is more, they split yours and charge accordingly. Image encoding can be used also to hide an information and the sender and receiver are only the persons who know the content. Its looks like cryptography technical and each other fix the base characters to be used.

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