Enhancing the Security of Communication Using Encryption Algorithm Based on ASCII Values of Data

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Abstract

The best way of exchanging the information is communication, due to this security of communication system become more challenging and typical day by day. Cryptography plays a major role in giving the data security which is transmitted over the internet work. The process of transforming the plain text is called encryption. Plain text is supposed to be the input of every encryption process and the corresponding cipher text is the output, whereas in the process of decryption the situation is opposite. As the process of decryption is converting cipher text in to plane text. This study presents the algorithms based on ASCII values of characteristics in the plane text for the encryption and decryption process. Since this effort has already been done by many researchers, but here we are trying to enhance the security by modifying the previously used string keys for the data encryption and decryption. The algorithm is presented for the symmetric cryptosystem in which same key will be used for the encryption and corresponding decryption process.

Keywords: Encryption, decryption, cryptography, 32-bit, 64- bit, transposition, shifted bit, plain text, cipher text, ASCII values.

1. Introduction

In today's world we are living with information age and it is almost impossible to see the world without internet. Huge amount of data is being transferred over the internet in every minute between the computers of different users for the purpose of professional and personal reasons. Due to this now it become necessary to secure such data, Physical security is not always a sufficiently feasible solution for such problems due to its cost and efficiency. Therefore the development in the methodology of virtual security become more advance day by day to secure the data. "The word cryptography was come from the "Greek" word "Kryptos" which defined as anything that is hidden obscure, secret or mysterious. Also defined by Yamen Akdeniz, the study of secret writing is cryptography". Cryptography concerned with the different way by which the communication can be prevented from being disclosed through various techniques. There are several ways of doing this procedure so that the only authorized people can read the message correctly. Cryptography is an art of designing or creating the code or secret message between sender and receiver. The process encryption is actually tries to make the information hidden or secret as much as possible, encryption is actually the main process of cryptography that

convert the main text in to some other meaningless and unintelligible information that appears to be randomly generated.

2. Related Work

Many encryption algorithms are available in the literature [1, 2, 3] few of them are incorporate with both substitution and transposition techniques [4, 5] and some of them are classified as symmetric key algorithm [6] that contains single key encryption and decryption. Stream cipher or block cipher is usually used by Symmetric-key encryption where as in Asymmetric cryptography [7] pair of key is used for the encryption decryption of messages. Several cryptographic algorithms are given in [8, 9, 10] which is based on ASC II values of messages to be encrypted.

The advantage of using secret key cryptography is that [16] it is easily to implement, much faster and takes less processing speed as compare to public key cryptography. Secret key cryptography is fast in computation.

Sign et al has proposed [11] data security with secret hiding advance computing, “to increase the diffusion and confusion characteristics of cipher text, Omolara et al [12] has provided a modified Caesar cipher and Vigenere cipher by incorporating techniques from modern ciphers such as xoring key to the first letter of plain text to the second letter”. Senthil et al [13] has presented the modern Creaser cipher substitution by using computational intelligence, “Disina et al [14] has built a method of encryption that based on the position of the bit in the message. Purnama et al [15] has used such a method of encryption in which the cipher text generated is legible and make it less suspicious to the cryptanalyst that the text has been encrypted”.

This study also deals with ASC II values of messages and providing two algorithms for the modern cryptography the security of the provided algorithm will be more enhanced by the implementation on 16 bits and 32 bits. Experimental results will show the efficiency of these algorithms.

This paper organizes as follows, section 1 gives the introduction with literature reviews, section 2 provides the detail about the decryption procedure, section 3 indicates the steps of encryption and decryption procedures, section 4 shows the provided algorithm's flow chart, section 5 displays the results on 16 and 32 bits, section 6 discusses the results and their efficiency, section 7 concludes the study and in the end there are references.

3. Proposed Method

Consider any plaintext P_1 and let the key be κ . Now generate the different version of keys by taking the double of first randomly generated value and rest of the keys will be generating by the same procedure. Take any character of the plane text and find its ASC II value, than by adding the ASC II value in to key value calculate ϵ_1 and by taking the right shift of ϵ_1 calculate ϵ_2 . Save the bit value of ϵ_2 to the decryption process and finally get the cipher text ϵ by taking the 2's compliment of the ϵ_2 on 16 bits. The same procedure is applied on 32 bits for more secure encryption procedure.

In the next algorithm we considering the plane text and make it transpose (in the reverse order). Generate the key and calculate the ϵ_1 and ϵ_2 with the same procedure as described above and finally obtained the cipher text with the 2's complement of ϵ_2 on 16 bits. This procedure may also be applied on 32 bits that provides more security as compare to previously generated procedures.

3.1. Algorithm based on Two's Complement and Right Shift Method

3.1.1 Algorithm for Encryption

Step 1: Begin
 Step 2: Take the plain text message as Input
 Step 3: Decide the value of key $\kappa[0]$.
 Step 4: Generate different key values κI , $1 \leq I \leq n$
 $\kappa[i] = \kappa[i-1] + \kappa[i-1]$;
 $\kappa[0] = \text{say } 25$;
 $\kappa[1] = \kappa[0] + \kappa[0]$;
 $\kappa[2] = \kappa[1] + \kappa[1]$; Etc...
 Step 5: Add the resultant Key in the value of plain text.
 Step 6: take the Right shift of the output of step 5 once.
 Step 7: Take the 2's Complement of the output of step 6
 Step 8: Pass on the Cipher text

3.1.2. Decryption Algorithm

Step 1: Start
 Step 2: Taking 2's Complement of Cipher text.
 Step 3: Left shift the output of step 2 once.
 Step 4: Add the shifted bit in output of step 3.
 Step 5: Subtract the key values from the resultant of step 4.
 Step 6: obtain the *ASCII* values from step 5.
 Step 7: Convert *ASCII* values to plain text.

3.2. For 16-bits

3.2.1 Encryption

S. No.	P.T	ASCII . V	κ	€1	€2	S.Bit	€
1	H	72	25	97	48	1	65488
2	I	73	50	123	61	1	65475
3	D	68	100	168	84	0	65452
4	E	69	200	269	134	1	65402

P.T = Plain text,
 ASCII.V = *ASCII Value*,
 κ = Key Value,
 $\text{€1} = \text{ASCII.V} + \kappa$,
 €2 = Right Shifted C1 once,
 € = Ciphertext (2's Complement of €2 on 16-bits).

3.2.2 Decryption

S. No.	€	P3	P2	P1	P.T
1	65488	48	97	72	H
2	65475	61	123	73	I
3	65452	84	168	68	D
4	65402	134	269	69	E

ϵ = ASCII equivalent of cipher text,

$\mathbb{P}3$ = 2's Complement of ϵ ,

$\mathbb{P}2$ = Left shifted $\mathbb{P}3$ once + S.Bit,

$\mathbb{P}1$ = $\mathbb{P}2 - \kappa$

$\mathbb{P}.T$ = Real Plain text Characters.

3.3. For 32-bits

3.3.2 Encryption

S. No.	$\mathbb{P}.T$	ASCII . V	κ	$\epsilon 1$	$\epsilon 2$	S.Bit	ϵ
1	H	72	25	97	48	1	4294967248
2	I	73	50	123	61	1	4294967235
3	D	68	100	168	84	0	4294967212
4	E	69	200	269	134	1	4294967162

$\mathbb{P}.T$ = Plain text,

ASCII.V = ASCII Value,

κ = Key Value,

$\epsilon 1$ = ASCII.V + κ ,

$\epsilon 2$ = Right Shifted $\epsilon 1$ once,

ϵ = Cipher text (2's Complement of $\epsilon 2$ on 32-bits).

3.3.2 Decryption

S. No.	ϵ	$\mathbb{P}3$	$\mathbb{P}2$	$\mathbb{P}1$	$\mathbb{P}.T$
1	4294967248	48	97	72	H
2	4294967235	61	123	73	I
3	4294967212	84	168	68	D
4	4294967162	134	269	69	E

ϵ = ASCII equivalent of ciphertext,

$\mathbb{P}3$ = 2's Complement of ϵ ,

$\mathbb{P}2$ = Left shifted $\mathbb{P}3$ once + S.Bit,

$\mathbb{P}1$ = $\mathbb{P}2 - \kappa$,

$\mathbb{P}.T$ = Real Plaintext Characters.

3.4. Flow Chart for Encryption & Decryption

3.5. Algorithm based on Two's Complement, Transposition and Right Shift Method

3.5.1 Algorithm for Encryption

- Step 1: Begin
- Step 2: Take the plain text as input.
- Step 3: Applying transposition on resultant of step 2
- Step 4: Decide the value of key $\kappa[0]$.
- Step 5: Generate different key values κI , $1 \leq I \leq n$
 $K[i]=\kappa[i-1]+\kappa[i-1]$;
 $\kappa[0]=$ say 25;
 $\kappa[1]=\kappa[0]+\kappa[0]$;
 $\kappa[2]=\kappa[1]+\kappa[1]$; Etc...
- Step 6: Add resultant Key in the value of plain text.
- Step 7: Right shift the output of step 6 once
- Step 8: Taking 2's Complement the output of step 7
- Step 9: Pass on the Cipher text

3.5.2 Decryption Algorithm

- Step 1: Begin
- Step 2: Taking 2's Complement of Cipher text.
- Step 3: Left shift the output of step 2 once.
- Step 4: Add the shifted bit in output of step 3.
- Step 5: Subtract the key values from the resultant of step 4.
- Step 6: Obtain the ASCII values from step 5.

Step 7: Perform back transposition on output of step 6.

Step 8: Convert *ASCII* values to plain text.

3.6. For 16-bits

3.6.1 Encryption

S. No.	P.T	Trans	ASCII . V	κ	€1	€2	S.Bit	€
1	H	E	69	25	94	47	0	65489
2	I	D	68	50	118	59	0	65477
3	D	I	73	100	173	86	1	65450
4	E	H	72	200	272	136	0	65400

P.T = Plain text,

Trans = Transposition (in reverse order),

ASCII.V = ASCII Value,

κ = Key Value,

€1 = $ASCII.V + \kappa$,

€2 = Right Shifted €1 once,

€ = Cipher text (2's Complement of €2 on 16-bits).

3.6.2 Decryption

S. No.	€	P3	P2	P1	B.Trans	P.T
1	65489	47	94	69	E	H
2	65477	59	118	68	D	I
3	65450	86	173	73	I	D
4	65400	136	272	72	H	E

€ = ASCII equivalent of cipher text,

P3 = 2's Complement of €,

P2 = Left shifted P3 once + S.Bit,

P1 = P2- κ ,

B.Trans = Back Transposition,

P = Real Plain text Characters.

3.7. For 32-bits

3.7.1 Encryption

S. No.	P.T	Trans	ASCII . V	κ	€1	€2	S.Bit	€
1	H	E	69	25	94	47	0	4294967249
2	I	D	68	50	118	59	0	4294967237
3	D	I	73	100	173	86	1	4294967210
4	E	H	72	200	272	136	0	4294967160

P.T = Plain text,

Trans = Transposition (in reverse order),

ASCII.V = ASCII Value,

κ = Key Value,

$\epsilon_1 = \text{ASCII.V} + \kappa$,
 $\epsilon_2 = \text{Right Shifted C1 once}$,
 $\epsilon = \text{Cipher text (2's Complement of } \epsilon_2 \text{ on 32-bits)}$.

3.7.2 Decryption

S. No.	ϵ	P_3	P_2	P_1	B.Trans	$P.T$
1	4294967249	47	94	69	E	H
2	4294967237	59	118	68	D	I
3	4294967210	86	173	73	I	D
4	4294967160	136	272	72	H	E

$\epsilon = \text{ASCII equivalent of cipher text}$,
 $P_3 = 2\text{'s Complement of } \epsilon$,
 $P_2 = \text{Left shifted } P_3 \text{ once} + \text{S.Bit}$,
 $P_1 = P_2 - \kappa$,
B.Trans = Back Transposition,
 $P.T = \text{Real Plain text Characters}$.

4. Results and Discussion

In the experiments we have calculated the executing time of the proposed algorithms on 16 and 32 bits using MATLAB simulations. The comparisons have been made with the two previously methodologies [5] and [8] in which the execution time has been evaluated on 4 bits. The results given by table 1 and table 2 are showing very good performance of the proposed algorithm based on two's complement and transposition method for 16 and 32 bits as it is very much less as compare to the technique 1 [8] which is on 4 bits, where as it is almost same as compare to technique 2 [5] except for some places. But in comparison with 4 bits they are much promising results for 16 bits as far as the security of cryptography is concerned. Similarly for the Transposition and Right Shift Method same observations can be seen by table 3 and table 4 for 16 and 32 bits respectively. The execution time is very less as compare to technique 1 given by [8]. The comparison made by proposed algorithm for 32 bits with the technique 2 given by [5] which is on 4 bits, is showing very less difference in the execution time.

Table 1. Comparison between Previously Developed Methodologies and Two's Complement Transposition Method for 16-bits

Size of Plaintext	Encryption & Decryption Execution Time (ms)		
	Execution time for existing algorithm (4-bit) in ms	Execution time for existing algorithm (4-bit) in ms	Execution time for proposed algorithm (16-bit) in ms
2	322	15	15
4	3679	15	16
6	3861	16	26
8	4748	16	37
10	5543	30	52

Table 2. Comparison between Previously Developed Methodologies and Two's Complement Transposition Method for 32-bit

Size of Plaintext	Encryption & Decryption Execution Time (ms)		
	<i>Execution time for existing algorithm (4-bit) in ms</i>	<i>Execution time for existing algorithm (4-bit) in ms</i>	<i>Execution time for proposed algorithm (32-bit) in ms</i>
2	322	15	31
4	3679	15	33
6	3861	16	42
8	4748	16	67
10	5543	30	98

Table 3. Comparison between Previously Developed Methodologies and Transposition and Right Shift Method for 16-bit

Size of Plaintext	Encryption & Decryption Execution Time (ms)		
	<i>Execution time for existing algorithm (4-bit) in ms</i>	<i>Execution time for existing algorithm (4-bit) in ms</i>	<i>Execution time for proposed algorithm (16-bit) in ms</i>
2	322	15	18
4	3679	15	19
6	3861	16	28
8	4748	16	50
10	5543	30	62

Table 4. Comparison between Previously Developed Methodologies and Transposition and Right Shift Method for 32-bit

Size of Plaintext	Encryption & Decryption Execution Time (ms)		
	<i>Execution time for existing algorithm (4-bit) in ms</i>	<i>Execution time for existing algorithm (4-bit) in ms</i>	<i>Execution time for proposed algorithm (32-bit) in ms</i>
2	322	15	40
4	3679	15	52
6	3861	16	99
8	4748	16	125
10	5543	30	171

6. Conclusion

The above study have presented two algorithm based on ASC II values of the data to enhance the security of communication regarding to cryptosystem. The proposed idea has been made possible by using the transposition and two's complement of the input values. The implementations have been shown on 16 and 32 bits of both the algorithms and experimental results have given the execution time of the related study. The study concludes that the proposed idea is not only good contribution in the literature of

cryptography but also provides more security in the text cryptography as far as the security is concerned. The provided algorithm is fast and reliable when compared with the other algorithms.

7. Future Scope

We can apply different schemes of Classical cipher to develop algorithms to enhance the security of communication regarding cryptosystem. Also we can develop algorithm not only for 16 or 32 bit but for 64, 128, 256 or higher bits for secure communication.

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