A Novel Approach for Encryption of Text Messages, Analysis and Implementation of Simple Coloumnar Transposition Cipher with Ceasar Cipher and Rail Fence Cipher in C/C++

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Abstract:- ***This paper is a step toward developing an encryption system which can encrypt any text message securely. An ad-hoc network generally consists of nodes, on which sensors are embedded to provide security measures .the main challenge of these sensors is to provide security of data and also to work effectively within a limitation of power and memory. In every important sector these networks are used to collect information or transfer them with a high level of security. For this reason here we require a strong encryption Technique. Cryptography is an art and science of converting original message into no readable form. There are two techniques for converting data into no readable form. Transposition technique, Substitution technique. In recent years there is drastic progress in Internet world. Sensitive information can be shared through internet but this information sharing is susceptible to certain attacks. Cryptography was introduced to solve this problem. Cryptography is art for achieving security by encoding the plain text message to cipher text. Substitution and transposition are techniques for encoding. When Caesar cipher substitution, Rail fence cipher and Columnar Transposition Cipher techniques are used individually, cipher text obtained is easy to crack. This talk will present a perspective on combination of techniques substitution and transposition. Combining Caesar cipher and rail fence with Columnar Transposition Cipher can eliminate their fundamental weakness and produce a cipher text that is hard to crack. Finally I have implemented this concept with the help of TURBO C++.***

Keywords: Cryptography, Cipher text, Substitution, Transposition, Caesar Cipher, Columnar Transposition Cipher, cryptanalysis, key,**C**

1. Introduction

This modern era is dominated by paperless offices-mail messages-cash transactions and virtual departmental stores. Due to this there is a great need of interchanging of data through internet. The dramatic rise of internet has opened the possibilities that no one had imagined. We can connect to any person, any organization or any computer, no matters how far we are from them. Internet cannot be used only for browsing purpose. Sensitive information like banking transactions, credit card information and confidential data can be shared through internet. But still we are left with a difficult job of protecting network from variety of attacks. With the lots of efforts, network support staff came up with solution to our problem named "Cryptography". Cryptography is the art of achieving security by encoding the data into unreadable form. Data that can be read and understood without any difficulty is called plain text or clear text. The method of encoding Plain text in such a way as to hide its content is called encryption. Encrypting plain text results in unreadable gibberish called cipher text. You use

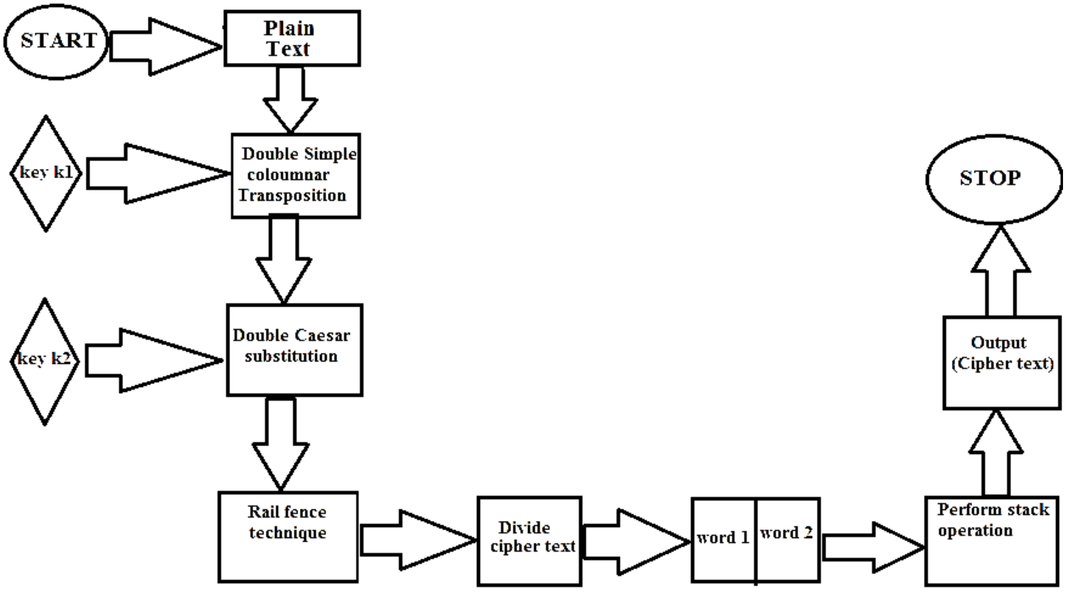
Encryption to ensure that information is hidden from anyone for whom it is not intended, even those who can see the encrypted data. The process of reverting cipher text to its original plain text is called decryption . There are two primary ways in which plaintext can b codified to corresponding Cipher text: Substitution and Transposition. A Substitution technique is one in which the letters of Plain text are replaced by other letters or by numbers(Caesar Cipher , Hill Cipher, Monoalphabetic cipher etc).A Transposition technique is one in which the letters of the message are rearranged or permuted. (Rail Fence method, Columnar method etc.). The columnar transposition cipher is a fairly simple, easy to implement cipher. It is a transposition cipher that follows a simple rule for mixing up the characters in the plaintext to form the cipher text. Although weak on its own, it can be combined with other ciphers, such as a substitution cipher, the combination of which can be more difficult to break than either cipher on it's own.

2. Proposed Work

A. Encryption Algorithm

1) First take the plain text to be encrypted from sender.
2) write the plain text in rectangular format across rows, order is determined by key k1.(Columnar transposition technique).
3) Read off the message column by column in order using Key K1,we get cipher text CT1.
4) Repeat step2 and 3,we get CT2
5) Perform substitution on CT2,using key k2,we get CT3
6) Repeat step5,we get CT4.
7) Perform Rail fence technique on CT4 we get,CT5
8) Now divide the cipher text(CT5),into two halves, as Word 1,andWord 2.
9) To add more complexity put these different words, on different stacks using PUSH operations, now POP the Values from stack, we get two words. Let it be CT6.
10) Finally CT6 is our required Cipher Text.

3. Block diagram for Encryption Algorithm



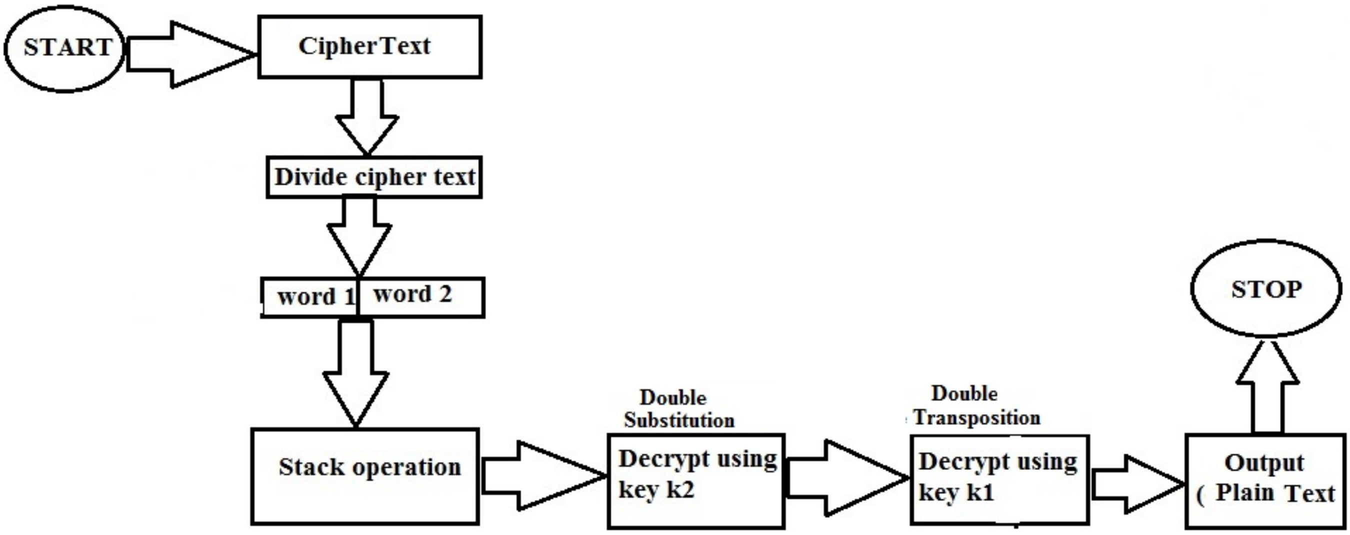
B. Decryption Algorithm

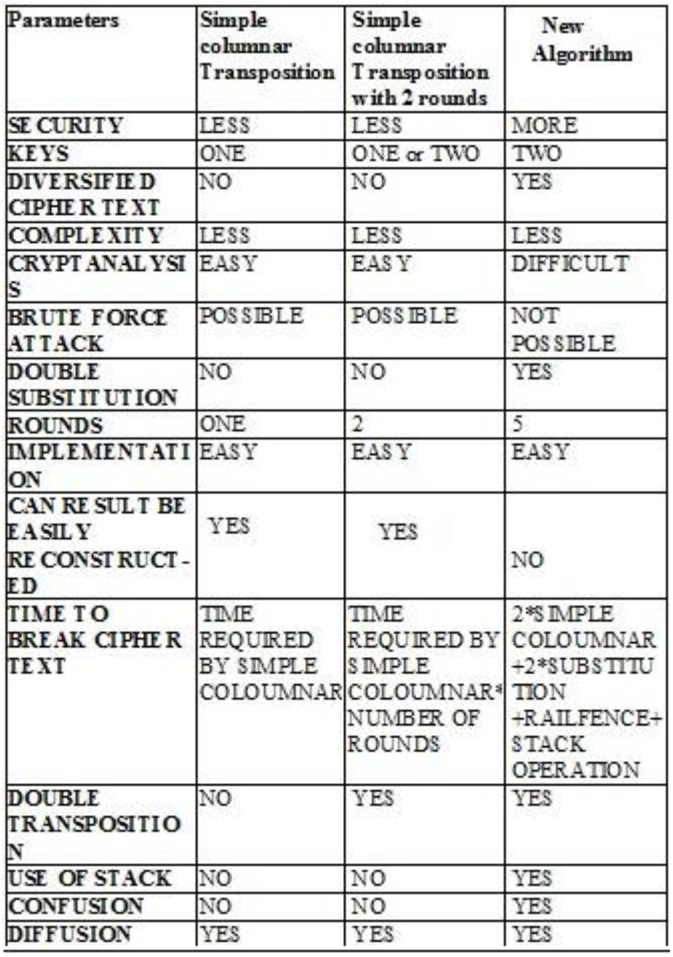
1) Write the cipher text to be converted into plain text,(CT6)
2) Divide cipher text as two separate words Word 1,and Word 2.
3) PUSH two words on to stacks, using different stacks
4) POP one element from stack one and second element from stack second(CT5).
5) Using Key K2 to decrypt CT5,we get CT4.
6) Repeat step 5,we get CT3
7) Arrange cipher text obtained in step 5(CT3),into rectangular format, as column by column using Key K1 and read of as rows. Let it be CT2
8) Repeat step 7,we get CT1
9) Read of row by row we get our plain text
10) Output of step 9 is our required plain text.

4. Block diagram for decryption algorithm

4.1 Analysis

Comparative study between New Proposed Algorithm and Simple columnar Transposition Cipher.





Parameters	Simple columnar Transposition	Simple columnar Transposition with 2 rounds	New Algorithm
SECURITY	LESS	LESS	MORE
KEYS	ONE	ONE or TWO	TWO
DIVERSIFIED CIPHER TEXT	NO	NO	YES
COMPLEXITY	LESS	LESS	LESS
CRYPTANALYSIS	EASY	EASY	DIFFICULT
BRUTE FORCE ATTACK	POSSIBLE	POSSIBLE	NOT POSSIBLE
DOUBLE SUBSTITUTION	NO	NO	YES
ROUNDS	ONE	2	5
IMPLEMENTATION	EASY	EASY	EASY
CAN RESULT BE EASILY RE CONSTRUCT-ED	YES	YES	NO
TIME TO BREAK CIPHER TEXT	TIME REQUIRED BY SIMPLE COLOUMNAR	TIME REQUIRED BY SIMPLE COLOUMNAR* NUMBER OF ROUNDS	2*SIMPLE COLOUMNAR +2*SUBSTITUTION +RAILFENCE+ STACK OPERATION
DOUBLE TRANSPOSITION	NO	YES	YES
USE OF STACK	NO	NO	YES
CONFUSION	NO	NO	YES
DIFFUSION	YES	YES	YES

5. Objectives

1) Overcomes limitations of simple columnar transposition cipher
2) Results cannot be easily reconstructed.
3) To understand the algorithm is not very difficult.
4) It is more difficult to crypt analyze.
5) It provides moderate complexity to encrypted messages
6) Simple to perform double substitution
7) Double transposition method is applied which provides much less structured permutation.

6. Result Analysis of New Algorithm

During comparative study or during graphical analysis of simple columnar transposition cipher with the proposed algorithm, we can notice that simple columnar is weak cipher, easily gets cryptanalyze when key length small (2, 3, 4, 5, 6).On other hand the Proposed algorithm can work successfully with small and large keys.

1) Time required to break the simple columnar transposition cipher can be analyzed as if key length is 2, then we need 2 permutations, if key length is 3 then we need 6 permutations and so on.
2) Time Required to break the simple columnar transposition cipher with multiple rounds can be analyzed as if key length is 2,the we need 2 permutation multiplied by number of rounds, if key length is 3,then we need 6 permutation multiplied by number of rounds and so on.
3) Time required to break the New Algorithm can be analyzed as, New Algorithm is a combination of simple columnar transposition, substitution, followed by rail fence and time require for performing stack operation. Therefore time required can be calculated as **2*simple coloumnar+2*substitution rail fence + stack operation.**

Let ' x' be the time required to break the cipher text of simple columnar transposition cipher, 'y' be the time required to break cipher text in Caesar cipher and ' z ' be the time required to break cipher text of rail fence cipher. Then

1. For simple Columnar Transposition T=x.

2. For simple Columnar Transposition with multiple rounds T=n * x

3. For Proposed New Algorithm T=2 * x + 2 * y + z + s

S= Time Required for Performing Stack Operation

For a particular Example if x=1,y=1,z=1 (x,y,z can be in sec,Min,Hours etc)

1.Then for simple columnar Transposition T=1.

2. For simple Columnar Transposition with multiple rounds T=2 * 1=2 for 2 rounds

3. For Proposed New Algorithm T=2 * x + 2 * y + z + s=2 * 1+ 2 * 1 + 1=5+

if x=2,y=2,z=2 (x,y,z can be in sec,Min,Hours etc)

1. Then for simple columnar Transposition T=2.

2. For simple Columnar Transposition with multiple rounds T=2 * 2=4, for 2 rounds

3. For Proposed New Algorithm T=2 * x + 2 * y + z + s=2 * 2+ 2 * 2 + 2=10+.

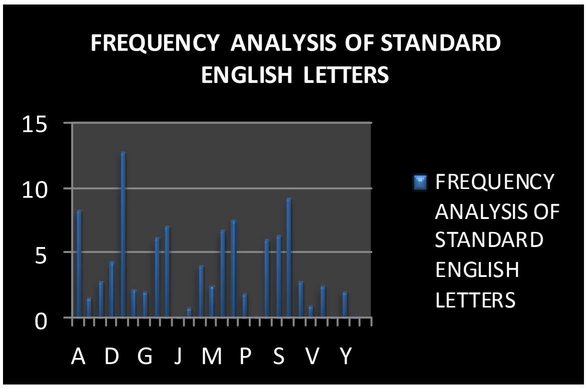
7. Advantages of Proposed Algorithm

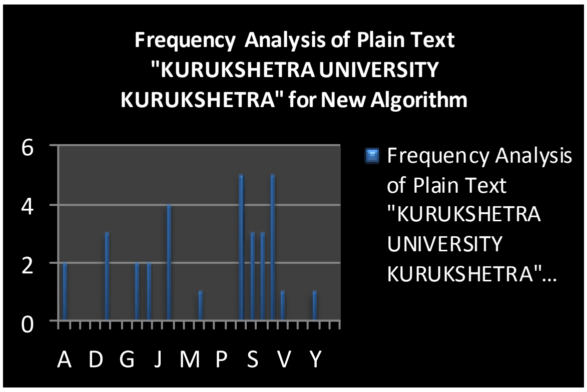
1. If we scrutinize at the Algorithm we can notice at every Stage we are getting diverse cipher text, thus more trouble to cryptanalyst.
2. It is more difficult to crypt-analyze.
3. Brute force attack is not possible.
4. It is simple to perform substitution.

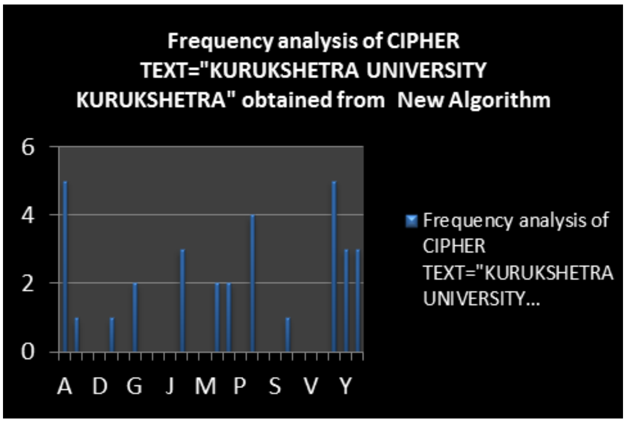
8. Disadvantages of Proposed Algorithm

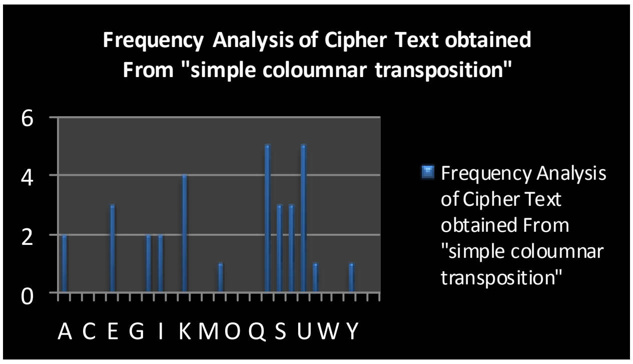
1. It makes use of two keys.
2. Also difficult to implement.

9. Graphical Analysis



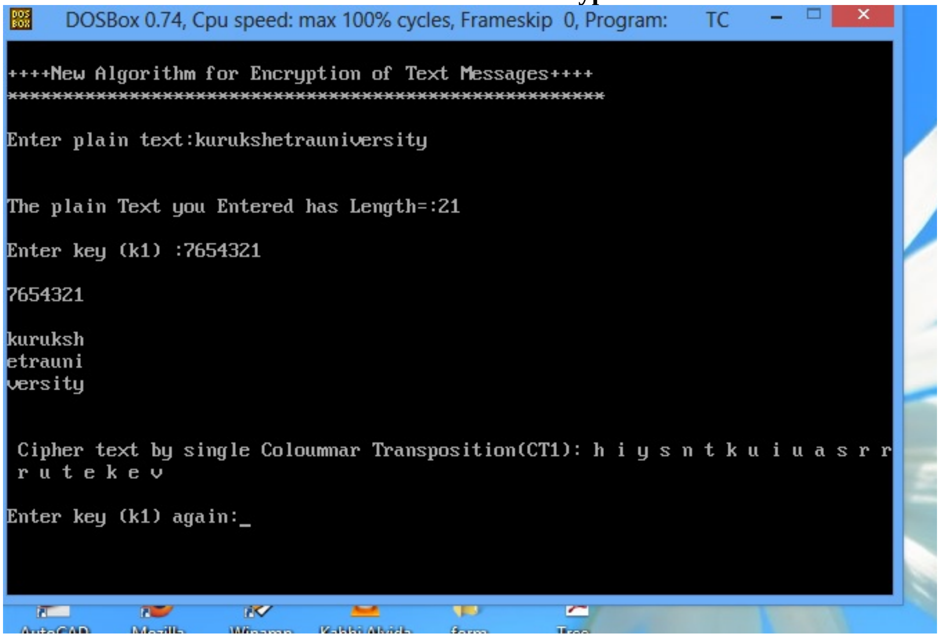






10. Implementation in TURBO C++

A. Encryption


DOSBox 0.74, Cpu speed: max 100% cycles, Frameskip 0, Program: TC

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++++New Algorithm for Encryption of Text Messages++++
*****************************************************

Enter plain text:kurukshetrauniversity


The plain Text you Entered has Length=:21

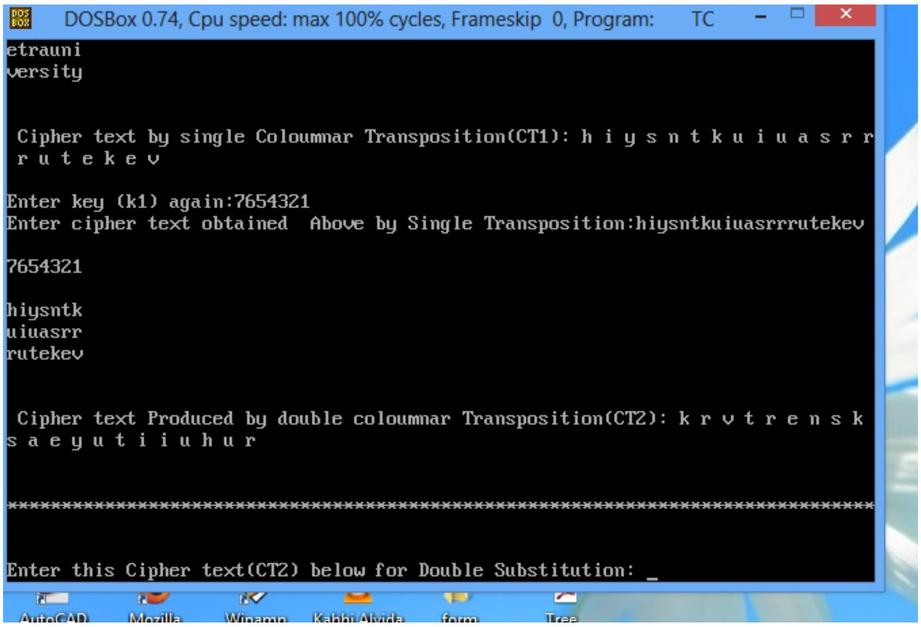
Enter key (k1) :7654321

7654321

kuruksh
etrauni
versity


 Cipher text by single Coloumnar Transposition(CT1): h i y s n t k u i u a s r r
 r u t e k e v

Enter key (k1) again:_
```


DOSBox 0.74, Cpu speed: max 100% cycles, Frameskip 0, Program: TC
AutoCAD
Mozilla
Winamp
Kabhi Alvida
form
Tree

```
etrauni
versity


 Cipher text by single Coloumnar Transposition(CT1): h i y s n t k u i u a s r r
 r u t e k e v

Enter key (k1) again:7654321
Enter cipher text obtained  Above by Single Transposition:hiysntkuiuasrrrutekev

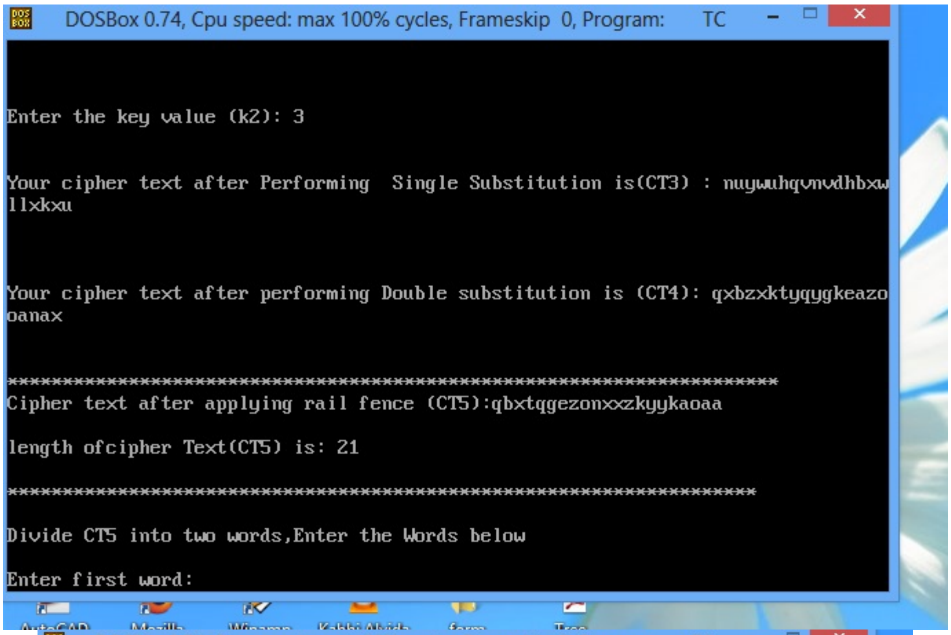
7654321

hiysntk
uiuasrr
rutekev


 Cipher text Produced by double coloumnar Transposition(CT2): k r v t r e n s k
s a e y u t i i u h u r


********************************************************************************


Enter this Cipher text(CT2) below for Double Substitution: _
```


DOSBox 0.74, Cpu speed: max 100% cycles, Frameskip 0, Program: TC
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Mozilla
Winamp
Kabhi Alvida
form
Tree

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Enter the key value (k2): 3


Your cipher text after Performing  Single Substitution is(CT3) : nuywuhqvnvdhbxw
llxkxu



Your cipher text after performing Double substitution is (CT4): qxbzxktyqygkeazo
oanax


**********************************************************************
Cipher text after applying rail fence (CT5):qbxtqgezonxxzkyykaoaa

length ofcipher Text(CT5) is: 21

********************************************************************

Divide CT5 into two words,Enter the Words below

Enter first word:
```

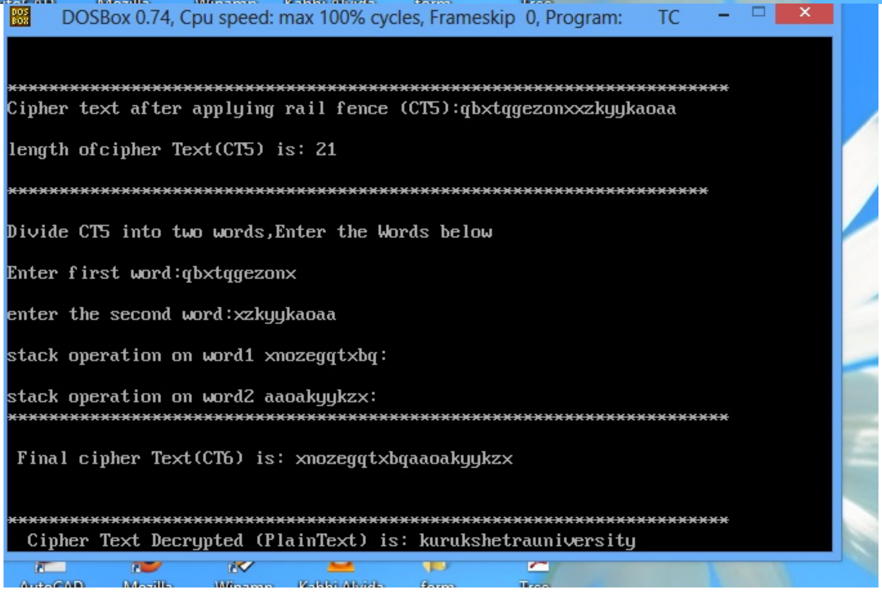
DOSBox 0.74, Cpu speed: max 100% cycles, Frameskip 0, Program: TC
AutoCAD
Mozilla
Winamp
Kabhi Alvida
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******************************************************************
Cipher text after applying rail fence (CT5):qbxtqgezonxxzkyykaoaa

length ofcipher Text(CT5) is: 21

****************************************************************

Divide CT5 into two words,Enter the Words below

Enter first word:qbxtqgezonx

enter the second word:xzkyykaoaa

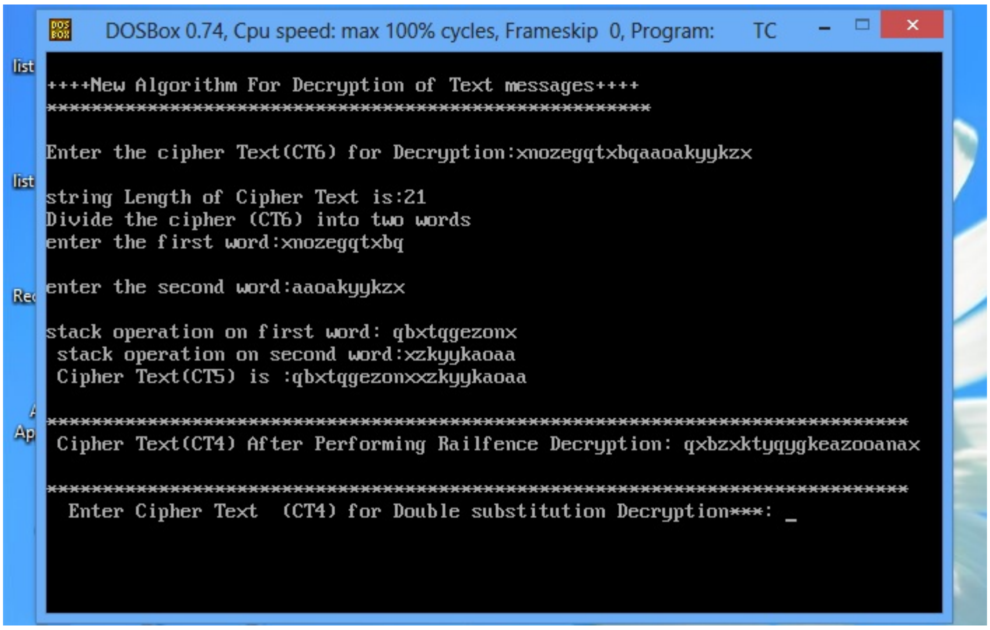
stack operation on word1 xnozegqtxbq:

stack operation on word2 aaoakyykzx:
******************************************************************

 Final cipher Text(CT6) is: xnozegqtxbqaaoakyykzx


******************************************************************
  Cipher Text Decrypted (PlainText) is: kurukshetrauniversity
```

B.Decryption


DOSBox 0.74, Cpu speed: max 100% cycles, Frameskip 0, Program: TC

```
++++New Algorithm For Decryption of Text messages++++
*******************************************************

Enter the cipher Text(CT6) for Decryption:xnozegqtxbqaaoakyykzx

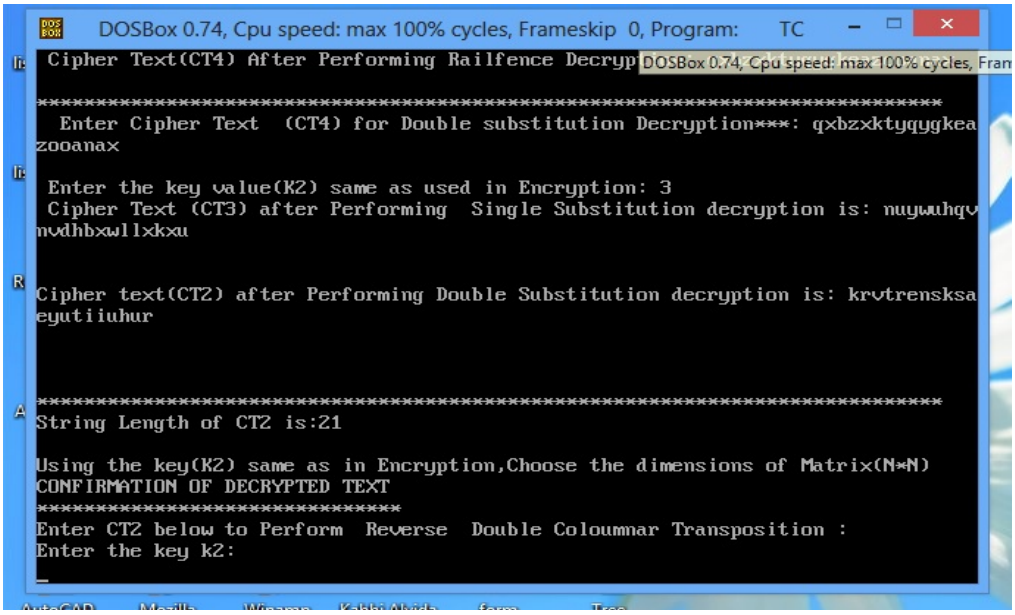
string Length of Cipher Text is:21
Divide the cipher (CT6) into two words
enter the first word:xnozegqtxbq

enter the second word:aaoakyykzx

stack operation on first word: qbxtqgezonx
 stack operation on second word:xzkyykaoaa
 Cipher Text(CT5) is :qbxtqgezonxxzkyykaoaa

******************************************************************************
 Cipher Text(CT4) After Performing Railfence Decryption: qxbzxktyqygkeazooanax

******************************************************************************
  Enter Cipher Text  (CT4) for Double substitution Decryption***: _
```


DOSBox 0.74, Cpu speed: max 100% cycles, Frameskip 0, Program: TC
DOSBox 0.74, Cpu speed: max 100% cycles, Fram

```
 Cipher Text(CT4) After Performing Railfence Decryp

******************************************************************************
  Enter Cipher Text  (CT4) for Double substitution Decryption***: qxbzxktyqygkea
zooanax

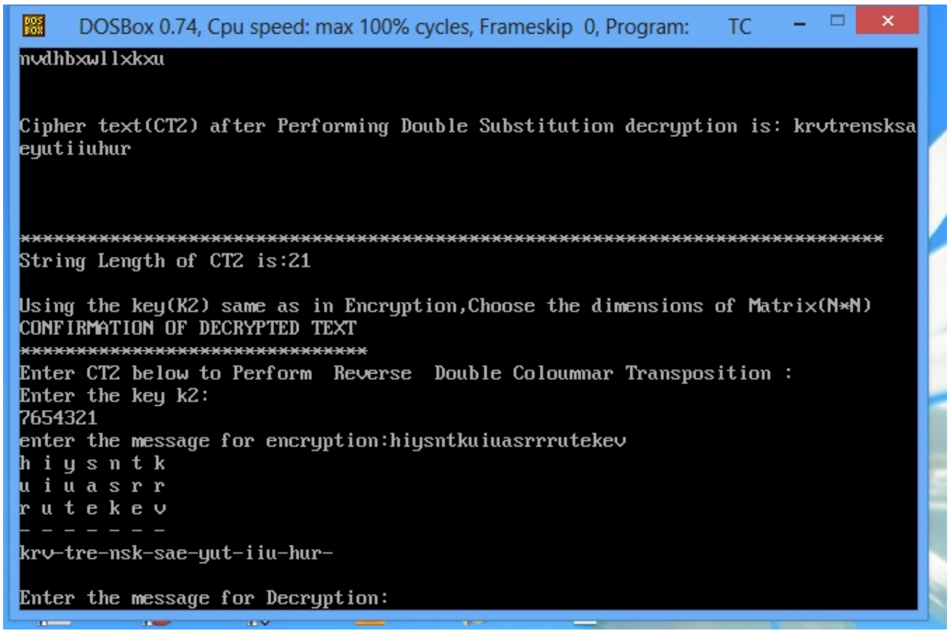
 Enter the key value(K2) same as used in Encryption: 3
 Cipher Text (CT3) after Performing  Single Substitution decryption is: nuywuhqv
nvdhbxwllxkxu


Cipher text(CT2) after Performing Double Substitution decryption is: krvtrensksa
eyutiiuhur



******************************************************************************
String Length of CT2 is:21

Using the key(K2) same as in Encryption,Choose the dimensions of Matrix(N*N)
CONFIRMATION OF DECRYPTED TEXT
********************************
Enter CT2 below to Perform  Reverse  Double Coloumnar Transposition :
Enter the key k2:
_
```


DOSBox 0.74, Cpu speed: max 100% cycles, Frameskip 0, Program: TC

```
nvdhbxwllxkxu

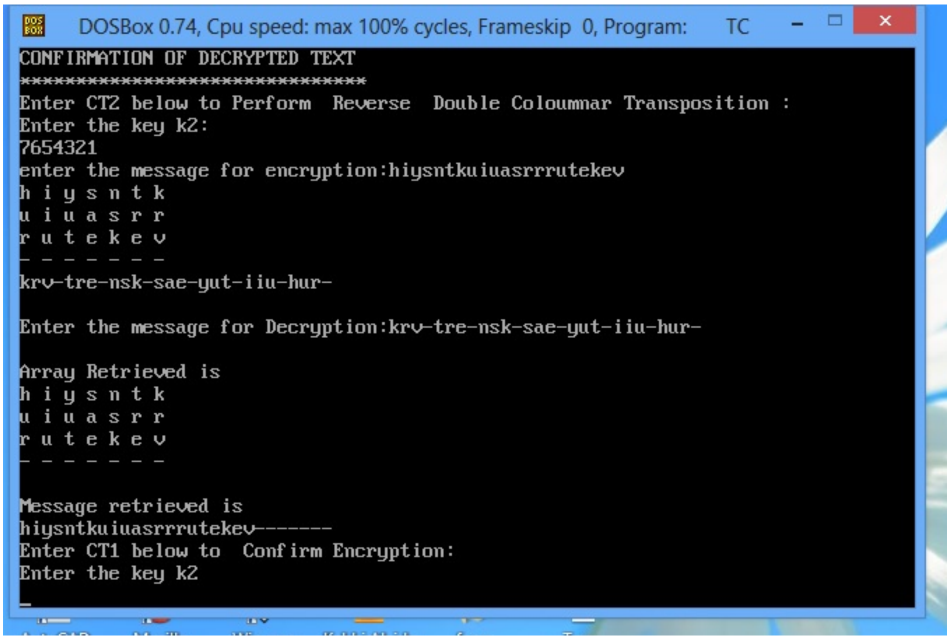

Cipher text(CT2) after Performing Double Substitution decryption is: krvtrensksa
eyutiiuhur



******************************************************************************
String Length of CT2 is:21

Using the key(K2) same as in Encryption,Choose the dimensions of Matrix(N*N)
CONFIRMATION OF DECRYPTED TEXT
********************************
Enter CT2 below to Perform  Reverse  Double Coloumnar Transposition :
Enter the key k2:
7654321
enter the message for encryption:hiysntkuiuasrrrutekev
h i y s n t k
u i u a s r r
r u t e k e v
- - - - - - -
krv-tre-nsk-sae-yut-iiu-hur-

Enter the message for Decryption:
```

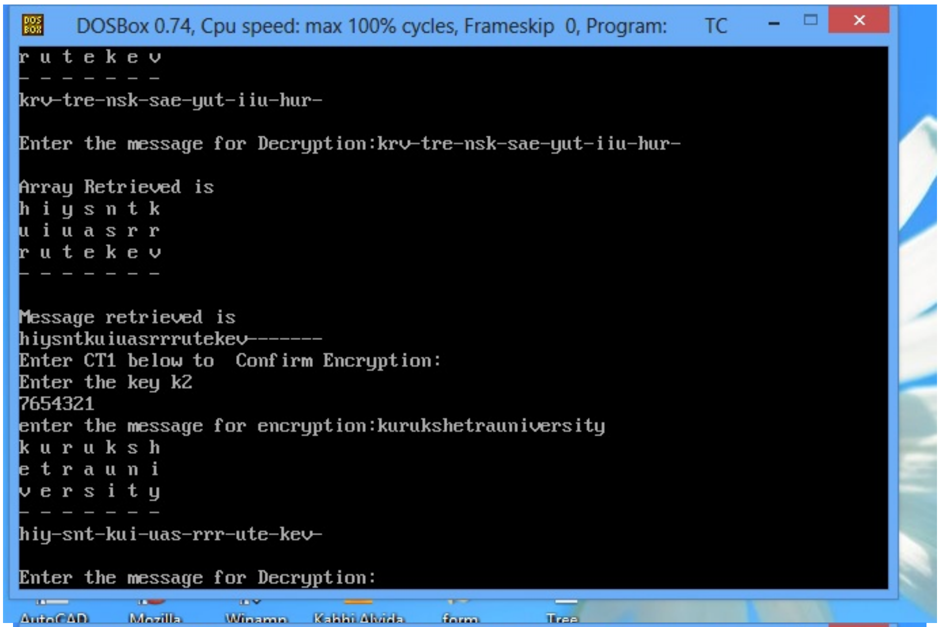

DOSBox 0.74, Cpu speed: max 100% cycles, Frameskip 0, Program: TC

```
CONFIRMATION OF DECRYPTED TEXT
********************************
Enter CT2 below to Perform  Reverse  Double Coloumnar Transposition :
Enter the key k2:
7654321
enter the message for encryption:hiysntkuiuasrrrutekev
h i y s n t k
u i u a s r r
r u t e k e v
- - - - - - -
krv-tre-nsk-sae-yut-iiu-hur-

Enter the message for Decryption:krv-tre-nsk-sae-yut-iiu-hur-

Array Retrieved is
h i y s n t k
u i u a s r r
r u t e k e v
- - - - - - -

Message retrieved is
hiysntkuiuasrrrutekev-------
Enter CT1 below to  Confirm Encryption:
Enter the key k2
_
```


DOSBox 0.74, Cpu speed: max 100% cycles, Frameskip 0, Program: TC
AutoCAD
Mozilla
Winamp
Kabhi Alvida
form
Tree

```
r u t e k e v
- - - - - - -
krv-tre-nsk-sae-yut-iiu-hur-

Enter the message for Decryption:krv-tre-nsk-sae-yut-iiu-hur-

Array Retrieved is
h i y s n t k
u i u a s r r
r u t e k e v
- - - - - - -

Message retrieved is
hiysntkuiuasrrrutekev-------
Enter CT1 below to  Confirm Encryption:
Enter the key k2
7654321
enter the message for encryption:kurukshetrauniversity
k u r u k s h
e t r a u n i
v e r s i t y
- - - - - - -
hiy-snt-kui-uas-rrr-ute-kev-

Enter the message for Decryption:
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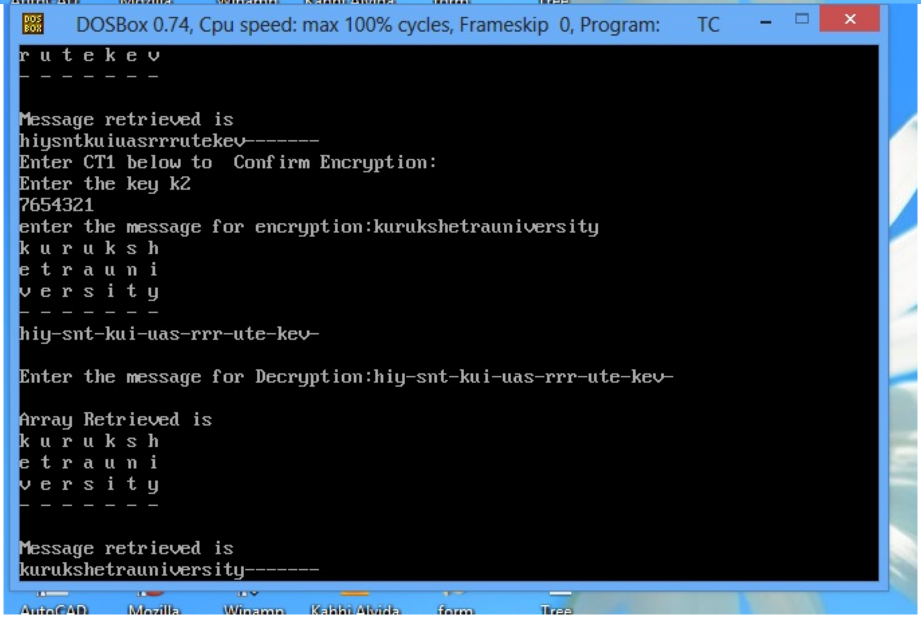
DOSBox 0.74, Cpu speed: max 100% cycles, Frameskip 0, Program: TC
AutoCAD
Mozilla
Winamp
Kabhi Alvida
form
Tree

```
r u t e k e v
- - - - - - -

Message retrieved is
hiysntkuiuasrrrutekev-------
Enter CT1 below to  Confirm Encryption:
Enter the key k2
7654321
enter the message for encryption:kurukshetrauniversity
k u r u k s h
e t r a u n i
v e r s i t y
- - - - - - -
hiy-snt-kui-uas-rrr-ute-kev-

Enter the message for Decryption:hiy-snt-kui-uas-rrr-ute-kev-

Array Retrieved is
k u r u k s h
e t r a u n i
v e r s i t y
- - - - - - -

Message retrieved is
kurukshetrauniversity-------
```

11. Conclusion

In this 3rd paper , I have presented how to improve security of Simple columnar Cipher to make it more secure and strong, and finally implement this concept in C/C++Moreover the proposed algorithm has lot of advantages in achieving secure communication than Simple One. Simple columnar transposition cipher is the simplest Transposition method. It is also the weak cipher. It's only advantage lies in the fact that it is not complex and can be understood easily. This advantage leads to the problem of easy detection. For overcoming this problem Caesar cipher and rail fence cipher is combined with transposition techniques. Transposition technique used here is simple columnar cipher. For adding further complexity stacks are used which makes the detection of both the techniques (Caesar cipher and rail fencing) difficult.

12. Future Work

Implementation in MATLAB,in future we try to implement it in MATLAB using MEX Function.

13. Acknowledgment

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