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Secure Data transmission using Recombinant DNA Cryptography and Morse Code Pattern

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Abstract- It is most important for an organization and individuals to secure their information from attackers and hackers to ensure information privacy, integrity and confidentiality of the data. To enhance the data security across the network, it is very significant to encode the data in unreadable form. Many research works are carried out in the evolution of cryptographic system however current development in this field is DNA Cryptography which is developed based on the computational ability of Deoxyribo Nucleic Acid (DNA). This paper provides triple layer security for data transmission in two methods. In first method, the encryption of the plain text into tRNA by Transcription method. Secondly, the generation of Morse code Pattern which improves the security of the message. In this method the tRNA is generated by DNA code and complementary rule.

Keywords- Cryptography, DNA, RNA, Morse code

I. INTRODUCTION

Concerns over the privacy and security of electronic information fall into two general categories: (1) concerns about inappropriate releases of information from individual organizations and (2) concerns about the structural flows of information through the organizations [1]. Cryptography is an art of science which converts the plain text into human unreadable form [2] i.e., Cipher text. The cryptography technique was developed by applying mathematical logics and algorithms to transmit the data in a secure form. The conversion method from plain text into cipher text is called as encryption. Transforming cipher text into plain text is called decryption.

1.1 DNA CRYPTOGRAPHY

DNA stands for Dioxy-ribo Nucleic Acid which contains the genetic information. DNA is composed of two long

1.2 MORSE CODE PATTERN

Morse code key is the earliest method used in Radio Telegraphy which has an alphabetic code of long and short sounds. chains which consists of double helical structure. It consists mainly of four bases, namely Adenine (A), Guanine (G), Cytosine (C) and Thymine (T), for the computation of DNA. The DNA computation process is achieved by forming the hydrogen bond between the thymine (T) with Adenine (A) and Guanine (G) with Cytosine(C). The basic representation of binary sequences for DNA nucleotides (table 1) is represented as below:

Table 1: Basic DNA Nucleodites

DNA Nucleotides	Binary sequence
A	**00**
C	**10**
G	**11**
T	**01**

International Morse code is a method of transmission of text information between sender and receiver. It is invented by Samuel F.B. Morse in the telegraphy field. This code encodes the original text to non- English natural language called "dots" which have short duration of sound and comparatively that for a longer duration ends are called "dashes" is shown in table 2. Length of silence denotes spaces and by varying this length of silence, one can differentiate between the letters or words.

Table 2: International Morse Code Pattern

CHARACTER	*MORSE CODE*
A	**.-**
B	**-...**
C	**-.-.**
D	**-..**
E	**.**
F	**..-.**

G	--.
H	....
I	..
J	.---
K	-.-
L	.-..
M	--
N	-.
O	---
P	--.
Q	--.-
R	.-.
S	...
T	-
U	..-
V	...-
W	.--
X	-..-
Z	--..

II. LITERATURE SURVEY

In 2017, A. Murugan and R. Thilagavthy proposed a paper named, Securing Cloud Data using DNA and Morse Code: A Triple Encryption Scheme. In this paper the DNA based Triple Encryption and Decryption algorithm is used so that it is highly impossible to hack the original data. This model is based on DNA molecules working in parallel to provide the security [13].

In the year 2009, Ning Kang proposed an algorithm namely, Pseudo DNA Cryptography [4]. In the process of 9999 Pseudocode DNA Cryptography, the original knowledge is translated into a DNA sequence. This sequence is translated into two types of DNA, namely spliced shape and protein shape. For doing so, introns are cut into defined patterns. The real DNA sequence for this method is not being used. Instead it uses the mechanisms of DNA action, hence the *term Pseudo DNA cryptography*. This approach is repeated with the main ideas of basic dogma in molecular biology including Transcription, translation and splicing.

In 2010, Souhila Sadeg et al, proposed an algorithm called Encryption algorithm inspired from DNA [5]. In this paper a plain text message is tran sformed into a matrix of 4 x 4 on which an initial permutation to generate a secr et key is performed.XOR operation is pe rformed with this generated key that is subject to transcription of the DNA mod ule (DNA to RNA) and translation (RNA to Protein). Pseudocode DNA Cryptography

In 2018, Ahmad Sharaieh et al, proposed an algorithm namely, An Enhanced Polyalphabetic Algorithm On Vigenere Cipher with DNA-Based Cryptography for the Vigenere cipher to avoid the limitations and the weakness of Vigenere cipher [6]. At worst, the EPCA has theoretical run-time of o(N).for the tested data, the EPCA shows improved performance in average memory space and closed results in average runtime.

In 2019, M.I. Moussa et al, proposed Information hiding using artificial DNA sequences based on Gaussian kernel function suggested a method which has two rounds of encryption [7]. This scheme is similar to the new method, the Data Encryption Standard (DES) algorithm. These two keys consist of the elliptic curve cryptography (ECC), and the Gaussian kernel function (GKF) and the nother key is generated on the second characters replicated in the first key based on random injective mapping. In the second DNA sequence the encryption message slowly hides correctly, based on GKF numbers.

1.1MORSE CODE- A SECURITY ENHANCER

In 2016, Manisha Barse and Rodney Manuel proposed a paper called Morse code, A Security Enhancer [8]. In this paper the information could be easily transmitted in the form of dots and dashes through the keyboard to obtain decoded output on the LCD in the form of alphabets and numbers. The circuit is very simple to implement and Morse code has high security as only skilled and learned persons can decode the information. The method of communication has got dual benefit of good bandwidth efficiency and low transmission power as compared to other coding schemes used in communication. Also it is more immune to inference both natural and man- made.

III. PROPOSED SYSTEM

DNA Cryptography can be defined as hiding data in terms of DNA sequence can be used to store and transmit data. The concept of using DNA computing in the fields of cryptography has been identified as a possible technology that may bring

forward a new hope for unbreakable algorithms. Strands of DNA are long polymers of millions of linked nucleotides.

Deoxyribo Nucleic Acid is a hereditary molecule in living organisms. The DNA carries the genetic instructions used in the growth, development, functioning and reproduction of all organisms. DNA and RNA are composed with nucleotides, which in turn composed of four nucleobases cytosine (C), guanine (G), adenine (A) and thymine (T) and deoxyribose and phosphate group.

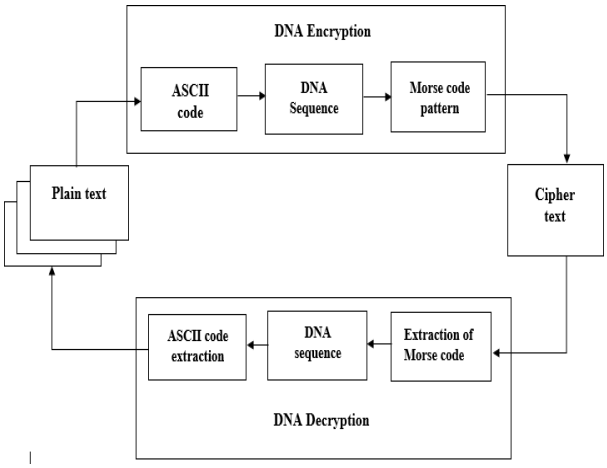


Figure 1: Block diagram of secure data transmission of DNA cryptography with recombinant DNA technique and Morse code pattern

The proposed system mainly provides triple layer security to the data being transmitted between the sender and receiver is shown in figure 1. The inputs are given in the form of text file. This model is proposed to encrypt original data at three levels. The original data in the file is converted into a binary sequence in first level. The next level is to convert the binary sequence into DNA sequence. This conversion uses the DNA nucleotides namely, A, G, C and T for the second level conversion. The third level conversion is done using Morse Code Pattern. The DNA sequence is converted into dot and dash format. The decryption of data is carried out by using the same method.

1.2 DNA CODE GENERATOR

In DNA Code Generation process, initially binary form of data is obtained by applying DNA code rule from the given input i.e., ASCII code. Secondly, the Transcription method is applied to get the messenger RNA sequence (mRNA). After deriving the mRNA sequence, tRNA sequence is obtained by applying Complementary rule. Those tRNA sequence are then converted into Morse Code pattern is shown in figure 2.

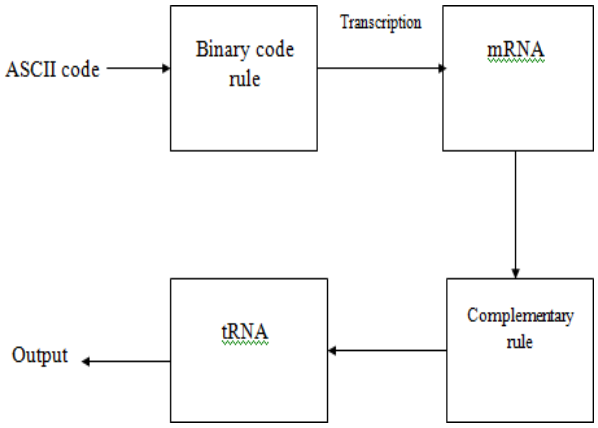


Figure 2: DNA Code Generation

The implementation of rDNA and Morse code modules involves two phases: Encryption phase involves the conversion of original text into cipher text while the decryption phase involves the reverse of encryption process.

3.2 ENCRYPTION PROCESS

The encryption phase involves the conversion of plain text into decrypted message. This encryption method involves the following steps:

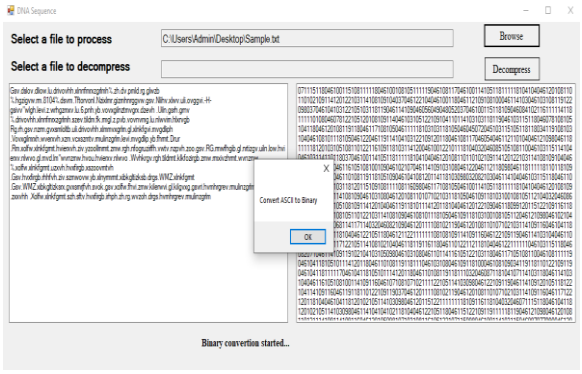
- ASCII code generation into binary bits
- DNA sequence phase
- Conversion of DNA code into Morse code

1.3 DECRYPTION PROCESS

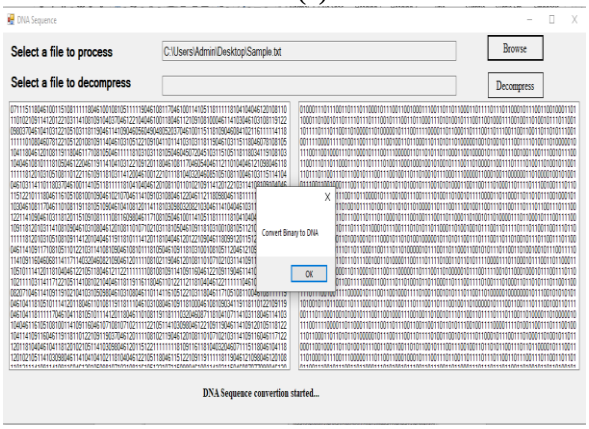
- The decryption process is the reverse of the encryption process.
- The obtained cipher text is extracted to obtain Morse code pattern.
- The Morse code is then converted into DNA sequence.
- The final phase is the conversion of DNA sequence into ASCII code from the binary bits.

IV. EXPERIMENTAL RESULTS

The triple layer security is provided by means of Encryption process at the source and the decryption process at the destination. The Encryption of the plain text is carried out in three process namely, Conversion of Plain text into ASCII code by applying Atbash Cipher substitution technique. The Binary form of the Derived ASCII code is obtained. The binary sequence of bits is converted into DNA code by applying the DNA sequence code rule is shown in figure 3a. The decryption process is the reverse of the encryption process where the final DNA code is converted to obtain the original text is shown in figure 3b.



(a)



(b)

Figure 3a, 3b: Decrypted message of cipher text

V. PERFORMANCE ANALYSIS

The Performance Analysis is a specialist discipline involving systematic observations to enhance performance and improve decision making, primarily delivered through the provision of objective statistical (Data Analysis) and visual feedback (Video Analysis). The overall performance analysis of the proposed work is given in the form of graph representation is shown in figure 4.

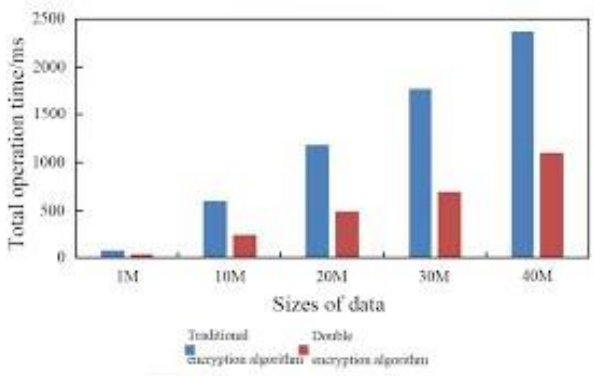


Figure 4: Comparison of encrypted and decrypted time per ms

VI. CONCLUSION

This paper proposes the triple layer security for data transmission in two methods: First, the encryption of the plain text is converted into tRNA by transcription method and the output of tRNA is converted into Morse code pattern. Pattern and the cipher text is stored in Morse code pattern which improves the security of the message. In this method the tRNA is generated by DNA code rule and complementary rule. The intended receivers only can able to decrypt the message with the secret key and the cipher text. This paper improves the embedding capacity of the encrypted message..

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