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Liquid Steganography - Secret Message as Living Cells using DNA Computing

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ABSTRACT: Leaking secret news (SM) can have disastrous consequences. For example, Queen Mary forfeited her life in the 16th century because of a leaked secret. The importance of protecting SM has led to the development of numerous technologies. Steganography, which involves preventing the discovery of SM, has been used for centuries. Throughout history, there have been many types of steganography, including steganography ink, acrostic, and wax-covered tablets. The ancient Greeks even hid messages in their hair by writing them on their scalps. The advent of imaging, audio, and video technologies has transformed steganography, and recently researchers have begun investigating the use of DNA to transmit and protect SM. DNA-based steganography technique, the data hiding method using duplicate DNA sequences, this project proposes a scheme for hiding SMs in living cells (SHSM). The main idea is to select a random pair of DNA sequences from the DNA database (S, Ś), which is a combination of two DNA sequences.

KEYWORDS: Cloud Service Provider, Complementary Pair Rule, DNA Encoding Rule, DNA-EXORRule, DecimalEncoding Rule, CloudSim.

I. INTRODUCTION

Information security and privacy are becoming increasingly important in this age of rapid development. As a result, a high level of security is required as it is a critical feature for thriving networks. Therefore, research in the field of data encryption techniques has been continuously advanced due to the need for powerful data protection in various applications. Applications such as annotation, property protection, copyright, verification, and military. Data hiding requires a carrier to hide the data in it, such as images, videos, and audio data. In the proposed method, the carrier of the data hiding is a DNA reference sequence. DNA is perhaps the most well-known biological molecule; it is present in all methods of life on Earth. Virtually every cell in your body contains DNA, or the genetic code that makes you up. DNA contains the commands for development, growth, reproduction, and the functioning of all life. Changes in the genetic code are why a person has blue eyes and not brown, why some people are prone to certain diseases, why birds have only two wings, and why giraffes have long necks. Amazingly, all the DNA in the human body, if shredded, would reach to the sun and back more than 300 times.

II. RELATED WORK

1. **Shyamasree C M and Sheena Anees proposed the DNA based Audio Steganography method which works in three levels [1].**

   First level makes use of DNA based Playfairalgorithm. The second level hides the secret message in a randomly generated DNA sequence. In the third level embedded DNA is hidden inside the Audio file.DNA digital coding is used to convert the raw data in secret file into DNA sequence. Any DNA sequence can be encoded using binary coding

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scheme. They have used the coding pattern A(00) , C(01) ,G(10) and U(11) to encode 4 nucleotides. The sequence of three nucleotides is called codon. There are total 64 possible codons. These codons are mapped to 20 standard amino acids. They have used playfair encryption algorithm to encrypt the sequence of amino acids. The encrypted DNA sequence is hidden inside randomly generated DNA sequence using two-by-two complementary rule. Finally, the embedded DNA sequence is hidden inside audio file using Least Significant Bit (LSB) modification technique.

2. **AmalKhalifa proposed LSBase: A key encapsulation scheme to improve hybrid crypto-systems using DNA steganography [2].**
   A hybrid crypto-system is public key system. They have used cryptography and steganography together to hide session key inside randomly generated DNA sequence. They have used codon degeneracy to hide information inside DNA sequences without affecting the type or structure of it. There are total 64 possible codons. These codons are mapped to 20 standard amino acids. Some amino acids are coded for more than one codon. This property is called codon degeneracy. This useful characteristic can be used to change the codon's last base while keeping its type (purine or pyrimidine).In other words, this algorithm changes the third nucleotide base of the codon into pyrimidine base or purine base if the secret bit is 0 or 1 respectively. Furthermore, the extraction process can be done blindly without any need to reference DNA sequence. The overall hiding payload is 1/3 bpn. It is showed to be the only blind technique that is capable of conserving the functionality of the carrier DNA.

3. **K. Menaka proposed the indexing technique to hide the secret message inside the randomly generated DNA sequence [3].**
   They have used three complementary rules: based on Purine and Pyrimidines, based on Amino and Keto groups, based on Strong and Weak H-bonds. Each letter in the DNA sequence is given the subscript index starting from 0. Message is converted to DNA sequence using digital coding pattern. Then the message index position in the faked DNA sequence is applied to each letter of the converted sequence. In this paper it has been pointed out that there are many properties of DNA sequences that can be utilized for encryption purposes.

4. **Bama R, Deivanai S, Priyadharshini K proposed DNA sequencing which ensures secured data authorization, storage and transmission [4].**
   DNA Sequencing for an Electronic Medical Record System has been introduced to access the patients' medical record securely and instantly. The Substitution approach uses two schemes which are kept secret between sender and receiver. These two schemes are binary coding scheme and complementary pair rule. The proposed scheme of DNA Sequencing is more reliable, efficient and secured.

5. **Siddaramappa V introduced data security by using random function in DNA sequencing [5].**
   They generate random numbers for each nucleotide and performs binary addition and subtraction on binary form of message and DNA sequence. This paper focus on the data security issues for providing a secure and effective encryption and decryption method by random number keys generation.

6. **RohitTanwar, Bhasker Sharma and Sona Malhotra introduced the robust substitution technique to implement audio steganography [6].**
   It is robust to various intentional and unintentional attacks and improves data hiding capacity. The basic problem to the substitution technique is identified and the possible solutions are proposed too. One problem is that they are less robust against intentional attacks and the second having low robustness against distortion. They have provided solutions to the two problems of substitution technique which is to use the deeper layer bits for embedding and other bits should be altered willingly to decrease the amount of error induced.

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III.METHODOLOGY

1. Liquid Steganography WebApp

   In this module we created a web-based application used to conceal important information through DNA Steganographyandprovidemeansofitssecuretransmissionthroughanymediumorchannel.

2. End User Management

   User Management is a system for authenticating users and storing user data. Our User Management APIs make managing your users easy. These APIs handley our user registration process, user authentication, and password management.

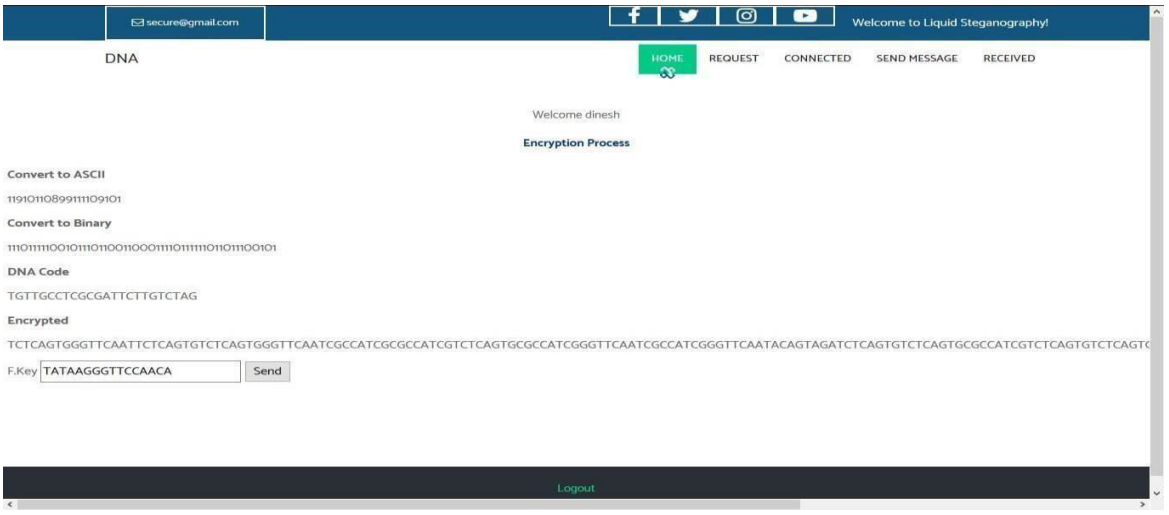
3. Key Generation and Distribution

In this module there exists a Key Distribution Center (KDC) that both Alice (Client-C) and Bob (Server-S) trust and they share keys with this KDC-this means that there already exist KKDC, C and KKDC, S. Client sends are quest to KDC with its own identity and that of a server-C, S.

The KDC generates shared key KC, S and sends to the client EKKDC, C (S, KC, S) and to the server EKKDC, S (C, KC, S).'

4. Secret Communication Protocol In this module
   we built with to techniques one is DNA-
   Based data hiding techniques using DNA Sequence an ther techniqueis Play fair cipher is used to encrypt and decrypt the DNASe
   quence.

IV.EXPERIMENT RESULTS



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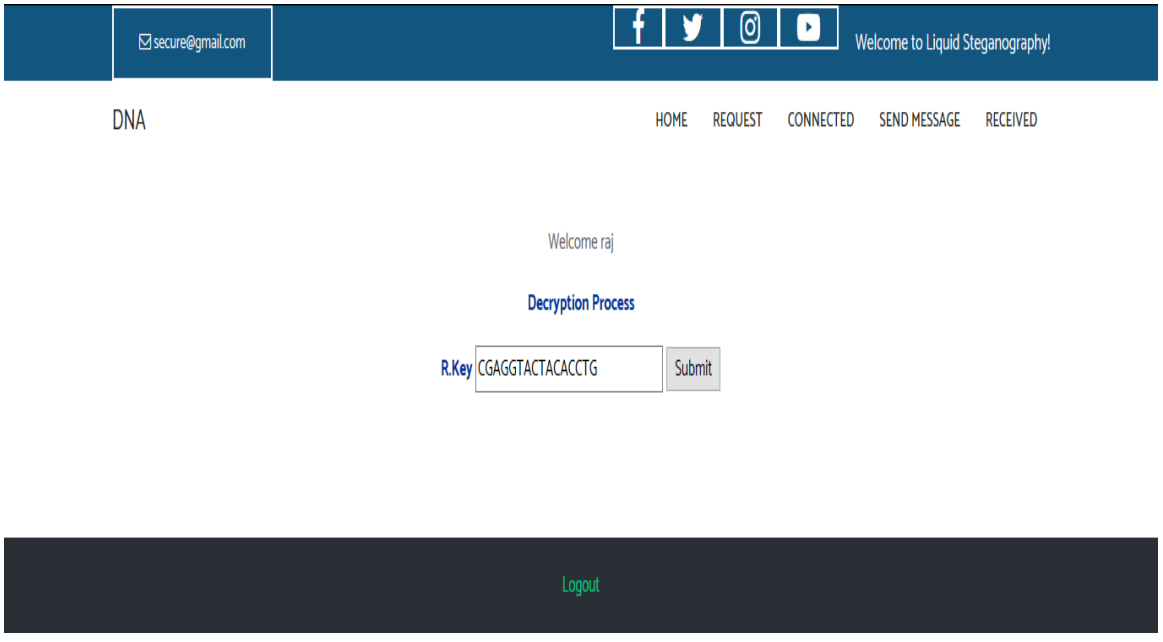

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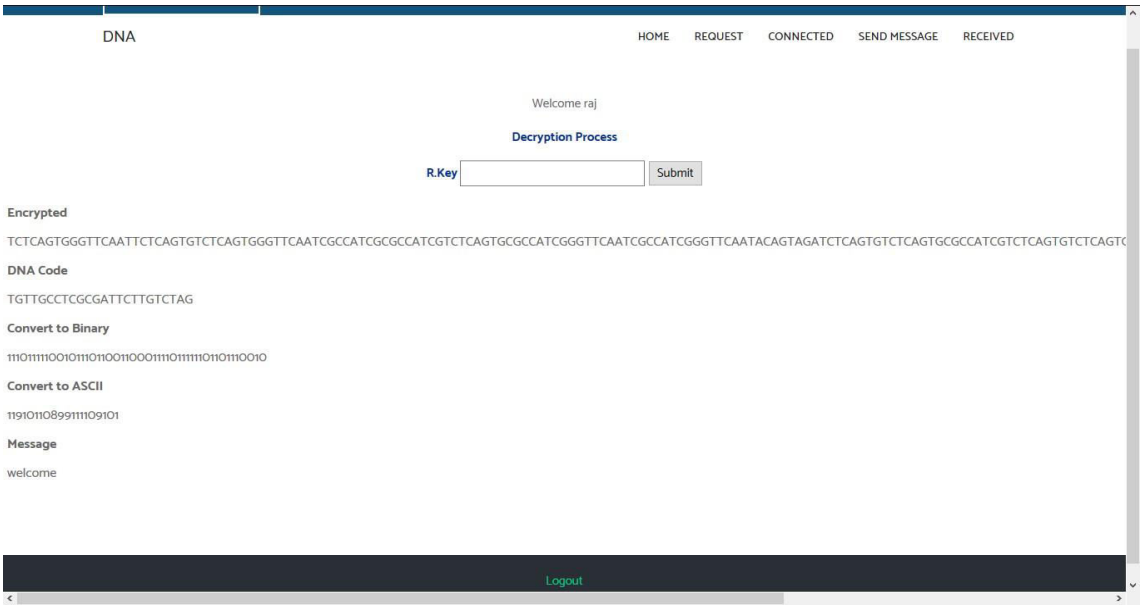

V. CONCLUSON

DNA as a storage medium is extremely effective. It is compact, biodegradable and consumes very little energy. Today it is used to propagate species, encode protein synthesis, and solve complex computational problems. Who knows what it will be good for in the future? Therefore, data hiding techniques to catalog, annotate, watermark, and/or encrypt information in this medium may be of great use. In this project, the original idea of hiding data in DNA and RNA is presented. In addition, two new and original techniques for hiding data are defined, along with an evaluation and analysis of the utility of each technique for the various functions of the hidden data. The first technique hides data in non-coding DNA such as non-transcribed and non-translated regions, and in non-genetic DNA such as DNA computational solutions. The second technique can theoretically be used to embed information directly into active genetic segments. In addition to a series of simple steps for embedding data, this paper also discusses the vulnerability of the codon redundancy technique to attack and offers several additional steps for reinforcing a watermark. The practical benefits of such a technique can be enormous.

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