DNA ENCRYPTION TECHNIQUE

INFORMATION SECURITY LAB - PROJECT SYNOPSIS [ICT 3126]

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INTRODUCTION:

Traditional digital encryption techniques, while effective, are constantly challenged by the rapid advancements in computing power. To address these challenges, this project explores DNA encryption, a cutting-edge approach that harnesses the natural properties of DNA to securely encode and store digital information.

Genetic Encryption is inspired by the processes of natural evolution and genetic recombination. Just as biological systems evolve over time through the mechanisms of mutation, crossover, and selection, data in a genetic encryption system is transformed through similar operations to achieve a secure encrypted output.

DNA is a nucleic acid which contains instructions for genetics. Adenine (A), cytosine (C), guanine (G) and thymine (T) form the four bases present in DNA. Binary data can be converted into these 4 bases and further operations can be performed on them similar to the manner in which biological events alter DNA sequences. This involves events such as crossing over, mutations, and replications, which are all involved in reshaping a particular DNA sequence.

OBJECTIVE:

DNA-based encryption mainly aims at devising an effective and new method for encoding, storing, and transmission of digital data based on the rules adopted from DNA sequences. For this to be achieved, DNA has to be used in such a manner that it will come up with an advanced encryption technique that protects information that is considered extremely important and which can't be vulnerable to cyber attacks.

Precise objectives are enumerated thus:

1. Secure Data Storage:

Develop an efficient encryption technique to transform digital data safely into a DNA sequence, maintaining information in an accurately protected form from unauthorized access.

2. Interdisciplinary Innovation:

Enable cryptography, bioinformatics, and synthetic biology to come together to drive innovation in new methods for developing encryption techniques.

3. Application:

The aim is to search for and develop helpful applications of DNA encryption, for example, in the field of secure communication. This is a novelty method of approaching encryption, where inspiration will be taken from the different events that happen on the DNA, such as mutations, repetitions, crossovers, and other kinds of modifications of the sequences.

FEATURES:

1. Binary-to-DNA Encoding Module

- Conversion Mechanism: Strong algorithm for converting binary data into DNA sequences, mapping the bits to nucleotide bases A, C, G, and T with high efficiency.
- Flexible Mapping Options: Allow different mapping schemes in order to enhance security and flexibility, thus enabling customization for various encryption needs.

2. Multi-Format Compatibility

- Enable the encryption and decryption of a wide range of data format-compatibilities (text, image) by following a standardized approach.

3. Encryption Algorithm

- Cryptography Techniques: Make use of high-level cryptographic algorithms exclusively designed for DNA information in order to secure the encoded data.
- Biological Encryption Methods: The inclusion of biologically inspired techniques reshapes, crossover mutations, etc., in addition to providing more security layers.

4. Decryption Module

- Decryption Mechanism: Strong mechanism that allows successful decryption of DNA into binary data, with full guarantee and accuracy of reconstruction of actual information.

5. User Interface

- User-Friendly Interface: Include a user-friendly interface for input, selecting the encryption option, and retrieving the decrypted information.

6. Interdisciplinary Collaboration Tools

- Bioinformatics Integration: Tools that enable collaboration throughout the process between cryptographers and biologists to ensure the gains of cross-disciplinarity are availed.

7. Scalability

- Support for Large Datasets: To handle large volumes of data and also leverage the high storage potential of DNA in encryption.

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