



SYSTEM AND METHOD FOR ENCODING AND DECODING ETHNIC DATA INTO GENETIC CODES

IITM Technology Available for Licensing

Problem Statement

- According to **UNESCO's World Atlas of Languages, Sanskrit is an endangered language.** Thus, **ethnic data such as mantras, slogans, verses etc are at a risk of being lost** to future generations
- Conventional methods** of preservation of ethnic data include **cultural practices** such as human memory or manuscripts based instructions in Veda paathashalas and **electronic storage** in DVDs, hard-drives etc.
- However, **traditional cultural practices have substantially eroded** due to foreign invasions and lingering effects of cultural colonialism while **conventional electronic storage devices can be hacked and are prone to damage** over longer periods of time.
- There is a **need to utilize DNA based encoding and decoding techniques to aid the conversion of ethnic data into genetic code** to enable storage of data in a highly encrypted format **for longer timespans**

Intellectual Property

IITM IDF Ref. 1718
IN 475673 Patent Granted
PCT Application No: PCT/IN2019/000025

Technology Readiness Level

TRL 6- Technology demonstrated in relevant environment

Technology Category/ Market

Technology: Data Science & Database System

Industry: Archives, Traditional Knowledge

Database, Database management Government & Defense, Banking, Data security, Manufacturing of data storage devices/ memory devices.

Applications: Storage of ethnic data, Securing national level official data such as government and defense data, archaeological data, defense data etc., can also be used to create experience systems of mythology within virtual reality environments generated by the computer system

Market: The global **DNA digital data storage** market is projected to expand at a CAGR of 64.4% during period from 2022 to 2035.

Research Lab

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Vedic mantras, verses from religious books

Example:

*om bhūr bhuvaḥ svaḥ
tat savitur vareṇyam
bhargo devasya dhīmahi
dhiyo yo naḥ pracodayāt*

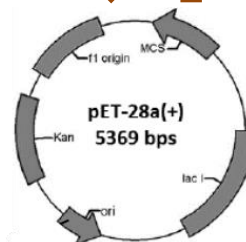
DNA Encoding
(VKRSV algorithm)

DNA Decoding
(VKRSV algorithm)



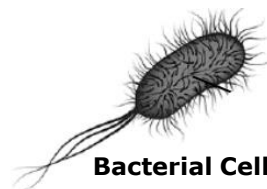
DNA Synthesis and
Molecular Cloning

Isolation of cloned
DNA and sequencing



Isolation of cloned
DNA from Bacteria

Transformation of
cloned DNA in
Bacteria



Bacterial Cells

Figure: A schematic representation of the steps for DNA cryptography system for encoding and decoding ethnic data including but not limited to, ancient mantras, slogans, and verses into genetic codes.

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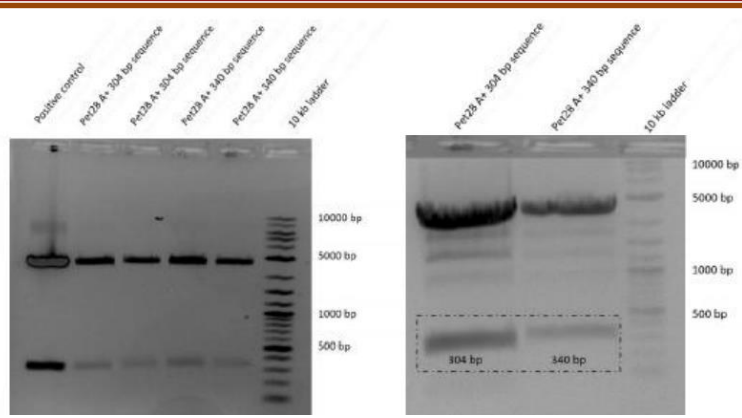


Figure: Colony PCR (Left side) and restriction mapping analysis (Right side) were carried out for selecting the desired recombinant transformants containing 304 bps and 340 bps nucleotide sequence among different recombinants.

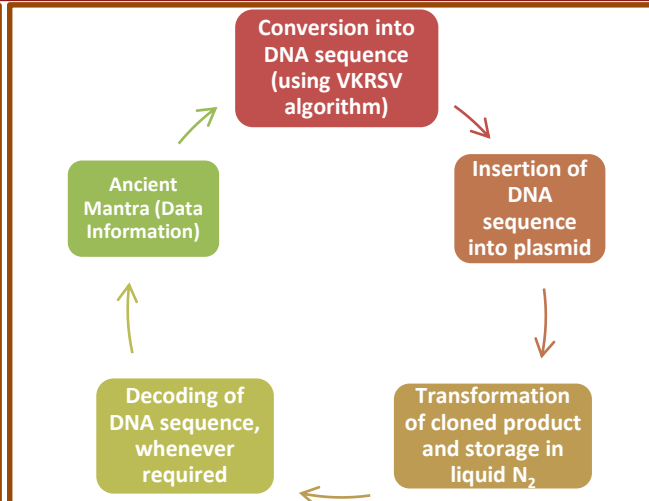


Figure: Five steps of DNA cryptography for securing ancient mantras, slogans and verses.

Technology

- A newly developed VKRSV encoding module for encoding the ethnic data into a genetic code stores the ethnic data securely for longer time periods
- The encoded data can be stored as a DNA nucleotide sequence having A, T, G, C format in order to hide data in an original format.
- the encoded mantra as a DNA nucleotide sequence form (304 bps and 340 bps) is cloned into a pET-28a + plasmid vector of 5.369 4 kbps size
- The cloned plasmid DNA is transformed into a bacterial system (E.coli) and stored at -80°C for long-term storage. This data can be retrieved using the same VKRSV decoding module

Key features/ Value Proposition

- As one gram of DNA carries 10^8 TB (TeraBytes) of data, the system can be used to store large amounts of data in a highly secure and compact manner. Whereas, one gram of silicon chip carries only 16 MB of data.
- The glycerol stocks of bacterial culture containing data can be stored in liquid nitrogen for a thousand years. Whereas conventional storage methods may get corrupted when stored for long periods of time.
- The processing time for encryption and decryption of data using DNA cryptography is much faster when compared to conventional cryptography methods.

	Traditional Cryptography	DNA Cryptography
Ideal System	Silicon Chip	DNA Chip
Information storage	Silicone Computer Chips	DNA strands
Processing time	Less	High
Storage capacity	1 gm silicone chip carries 16 mega bytes	1 gram of DNA contains 10^8 TB (Terabytes)
Performance dependency	Implementation and system configuration	Environmental conditions

Figure: Basic comparison between traditional and DNA cryptography