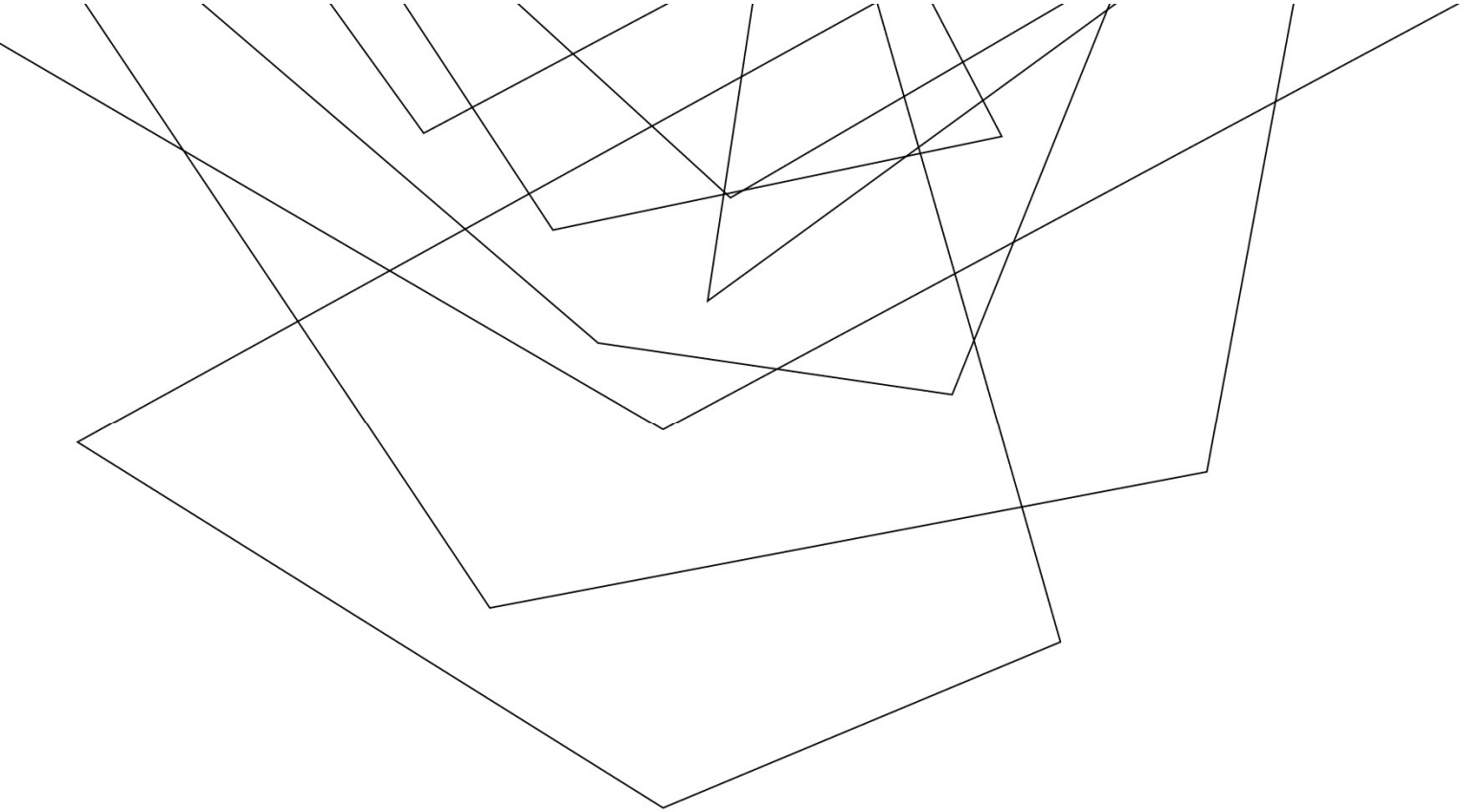
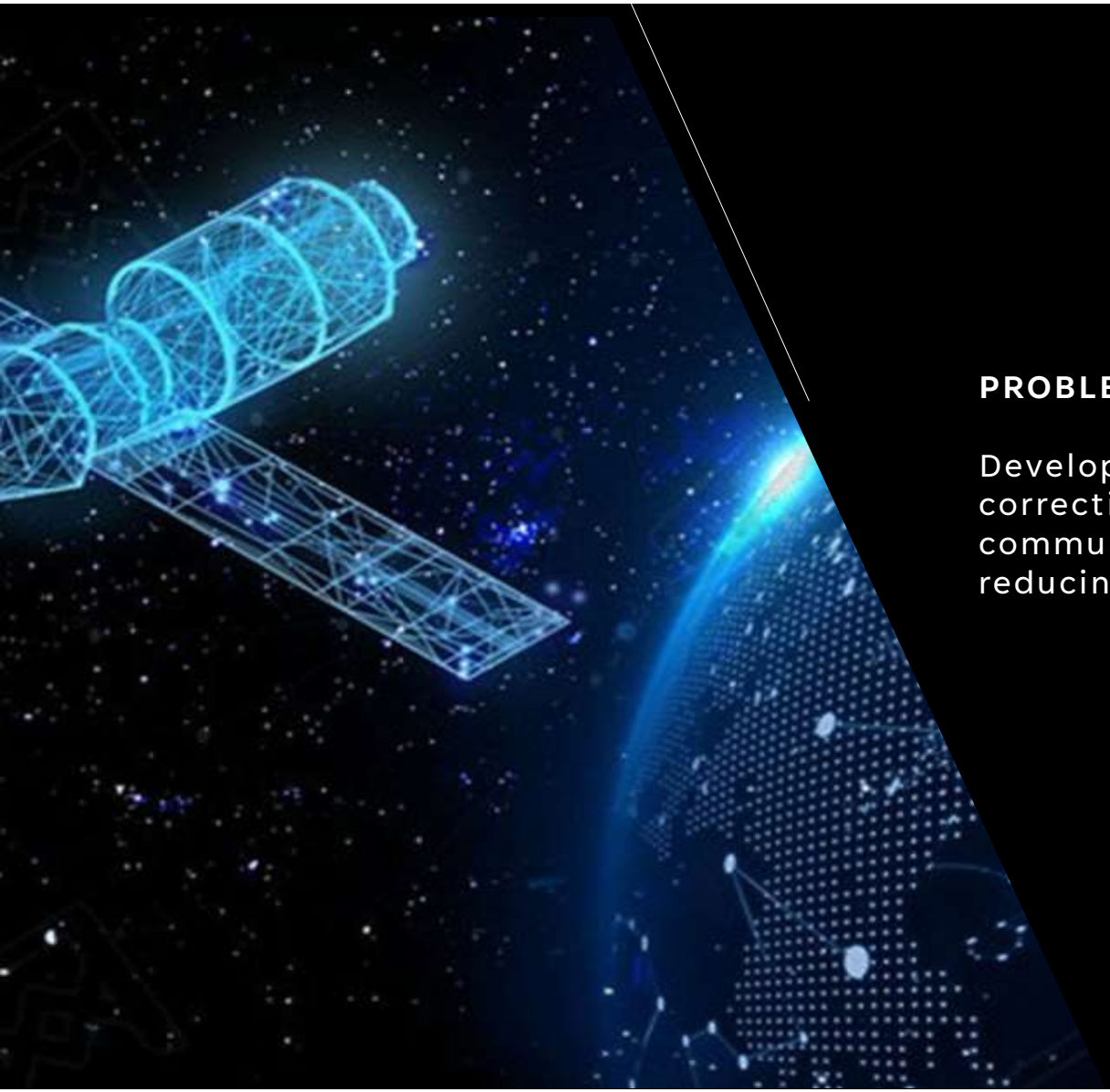


IMPROVING SATELLITE AND DEEP SPACE COMMUNICATIONS USING REED-SOLOMON CODES

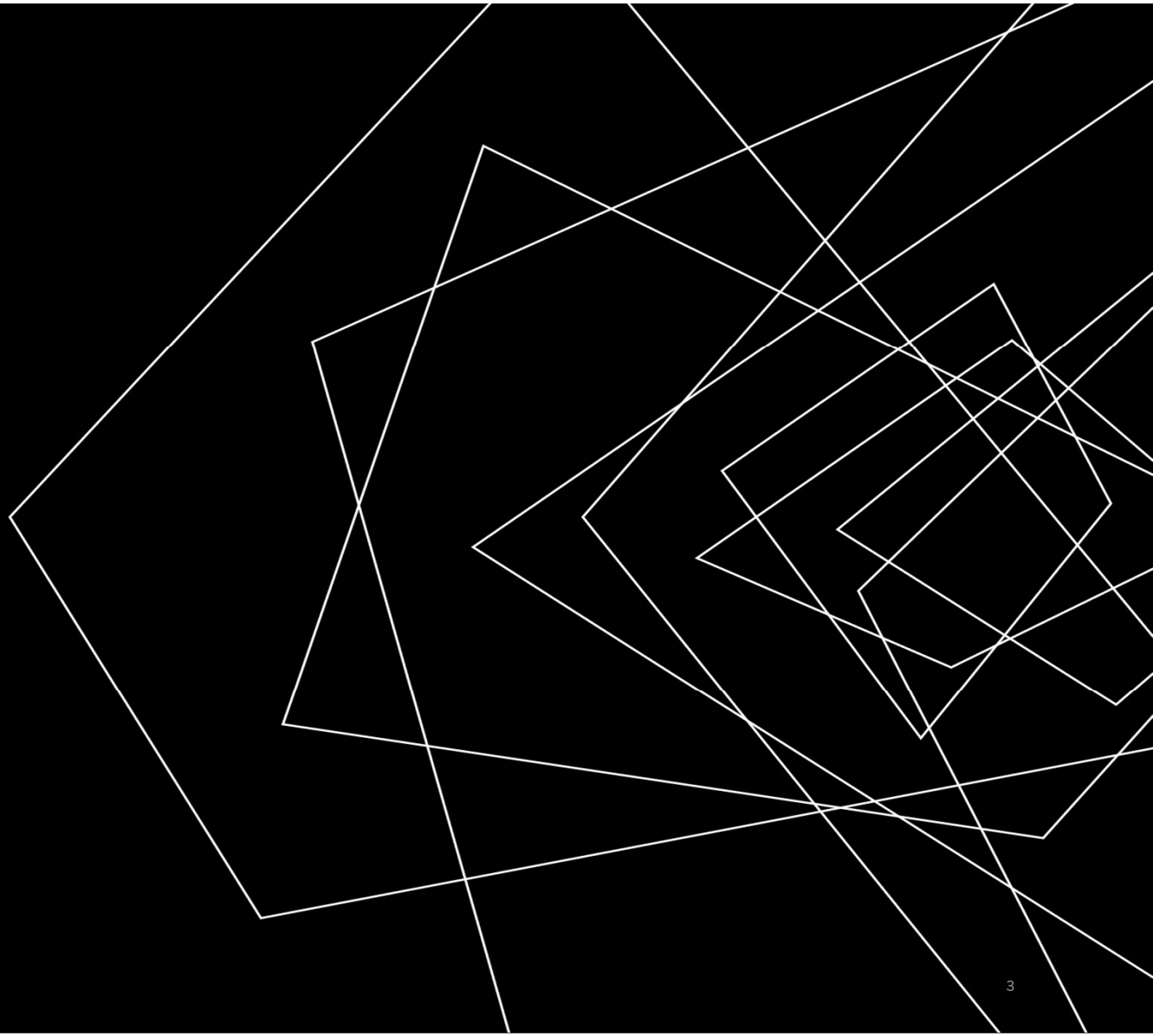


PROBLEM STATEMENT:

Develop an optimized reed-solomon error correction scheme to enhance data communication reliability in space missions by reducing computational power requirements.

BACKGROUND:

In the challenging environment of space, satellites and space probes are exposed to cosmic rays and radiation that can cause data corruption. This is a critical issue for scientific missions that rely on accurate data transmission and storage. Ensuring data integrity over long-duration missions requires robust error correction methods.



CHALLENGE:

Create an efficient Reed-Solomon decoding methodology that can accurately detect and correct errors in received signals. The primary challenge is to optimize the error correction process to ensure reliable data recovery while accommodating the constraints of space missions, including limited computational resources and storage capacity.

DESCRIPTION:

We propose developing a reed-solomon-based error correction scheme designed for onboard data storage in satellites and space probes. The goal is to safeguard critical scientific data against bit flips caused by cosmic rays and other space-based radiation. Our approach includes designing a comprehensive error correction system and an efficient reed-solomon decoding methodology that ensures reliable data recovery. This system will optimize the process for operation within the limited computational and storage resources available in space-constrained environments.

INTRODUCTION TO REED-SOLOMON:

Overview : Reed-Solomon coding is an advanced error correction technique based on polynomial algebra over finite fields. It excels in correcting multiple-bit errors and is used to enhance the reliability of data transmission and storage systems. The Voyager spacecraft used Reed-Solomon coding to transmit images over vast distances, ensuring data accuracy even between Saturn and Uranus.

How It Works:

Encoding**:** Data is divided into blocks and represented as polynomials. Redundant symbols are added to these polynomials, creating a codeword with built-in error correction capability.

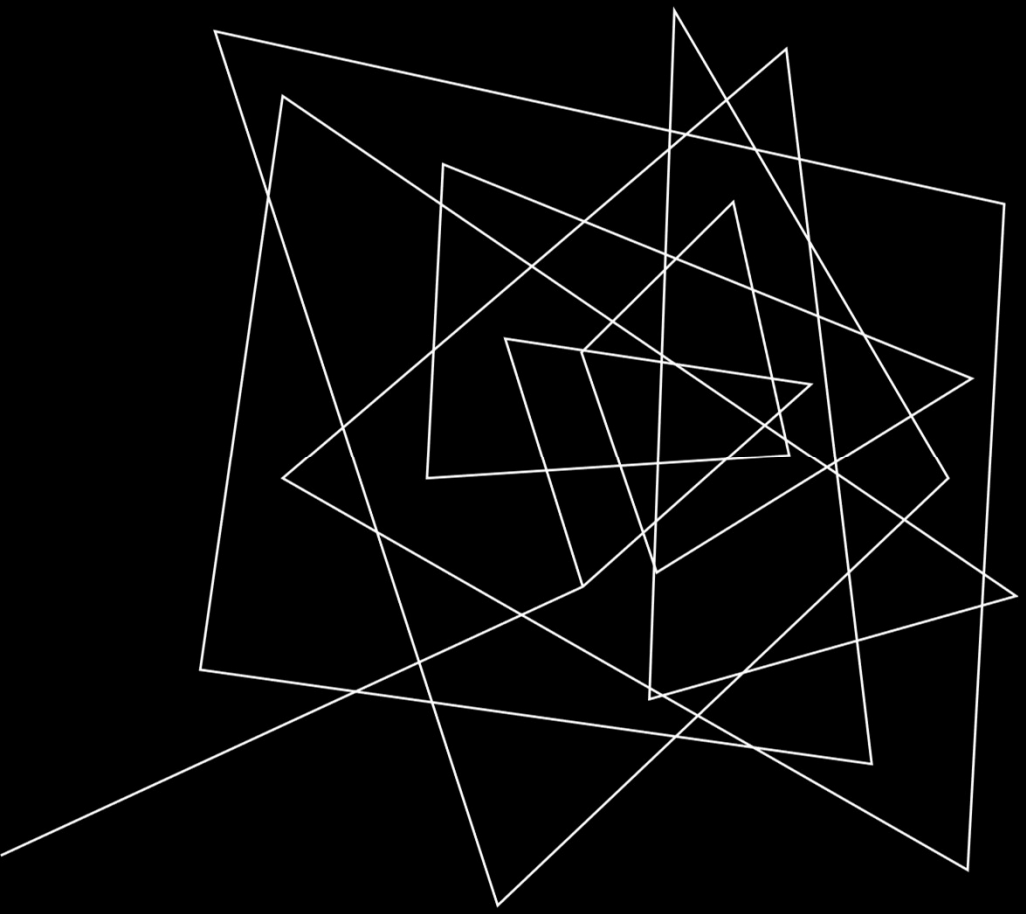
Transmission/Storage: The encoded data is sent over communication channels or stored on media.

Decoding: Upon reception, the data is checked for errors using the redundant symbols. The Reed-Solomon decoding algorithm identifies and corrects errors, recovering the original data.

Implementation:

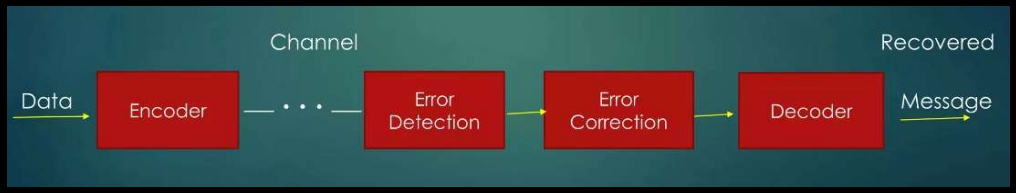
Data Encoding: Use polynomial-based encoding to add redundancy to data blocks.
Data Transmission/Storage: Implement the encoded data in your system, whether for communication or storage.

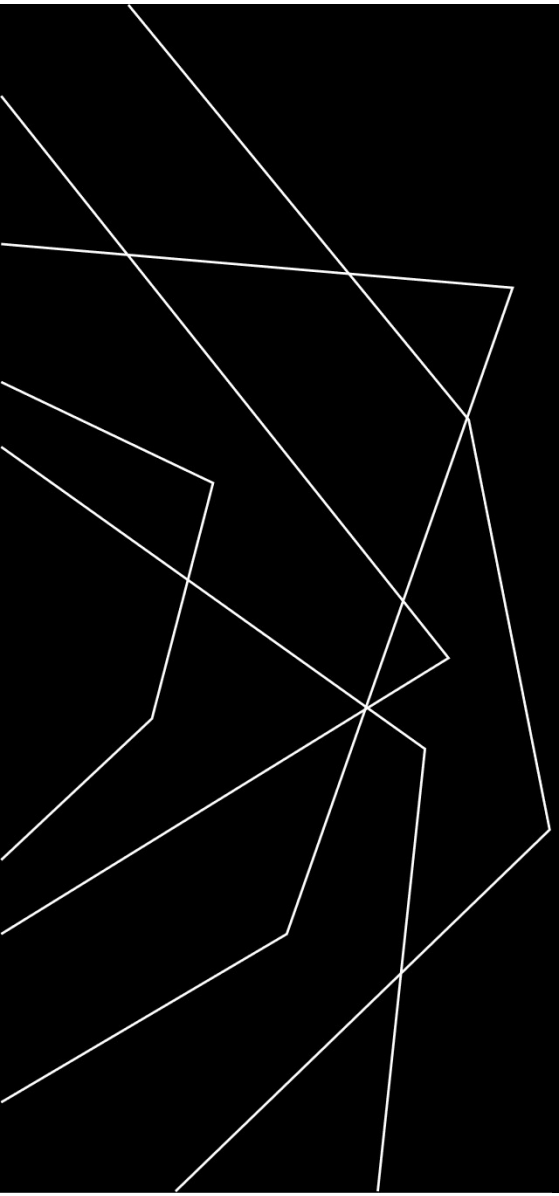
Error Detection and Correction: Apply the Reed-Solomon decoding process to correct errors and retrieve accurate data.



APPROACH:

To enhance space communication using reed- solomon codes, we will focus on reducing computational power requirements. This involves implementing efficient reed - solomon encoding and decoding algorithms, to minimize computational demands. Additionally, we will develop adaptive techniques to dynamically adjust error correction levels based on real-time conditions. The aim is to ensure that reed- solomon coding operates effectively within the limited computational resources available on spacecraft, balancing error correction needs with system constraints.





THANK YOU

Team - HANA