



IMAGE STEGANOGRAPHY PROGRAM USING LEAST SIGNIFICANT BIT

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Abstract : This study presents an implementation of an image steganography program using the Least Significant Bit (LSB) technique. The program allows users to encode a secret message into an image and subsequently decode the hidden message. By manipulating the least significant bits of pixel values, the message is embedded in a way imperceptible to human vision. The encoding process converts the secret message into binary and modifies pixel data, while the decoding process extracts the binary message and reconstructs the original text. The system is developed in Python using the Pillow library, supporting standard image formats. The project enhances data security and confidentiality, making it a useful tool in secure communication.

IndexTerms- Data hiding, Secure Communication, Carrier Image, Least Significant Bit (LSB).

I. INTRODUCTION

Steganography is the art of hiding information within non-secret data. The Least Significant Bit (LSB) method modifies pixel values to embed a hidden message, ensuring covert communication. This technique is widely used in ethical hacking and data security applications, providing a means of safeguarding sensitive information. This project implements LSB steganography using Python and the Pillow library for image manipulation.

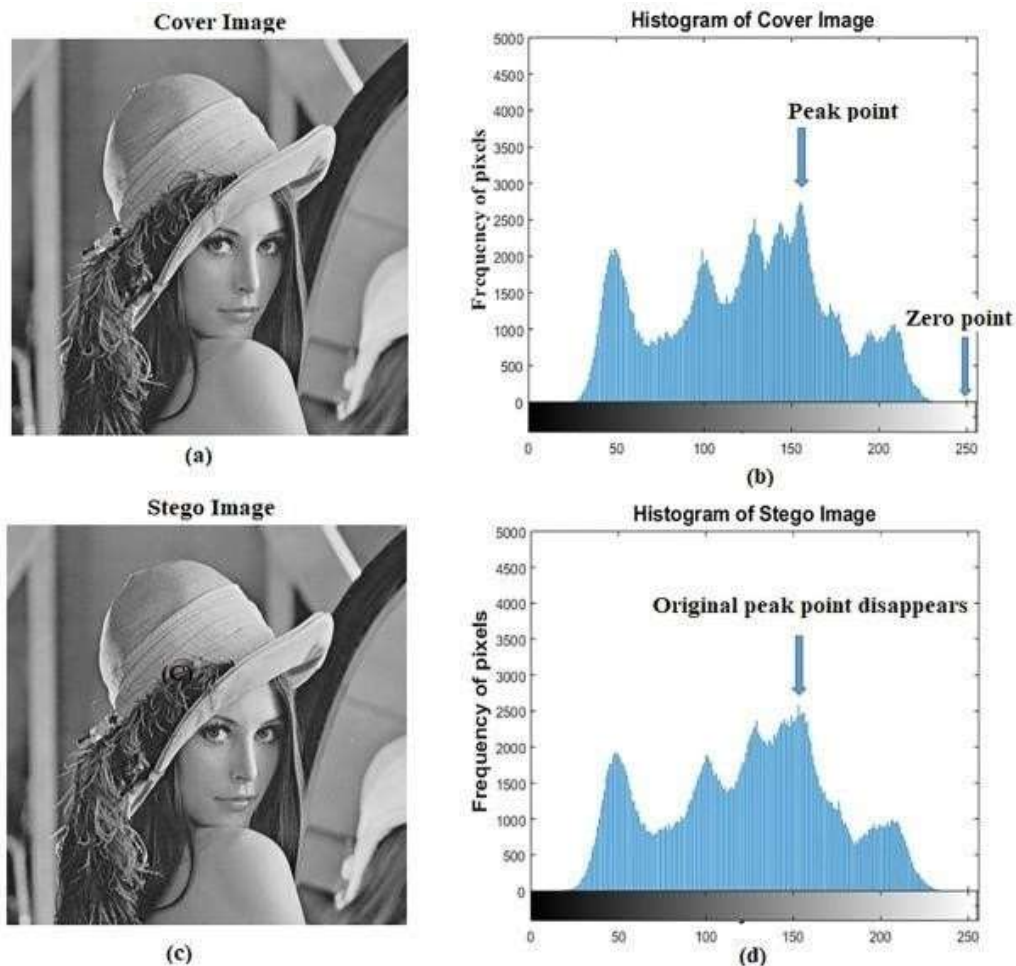
II. RELATED RESEARCH

The Least Significant Bit (LSB) technique is extensively studied in digital steganography. Previous research highlights its effectiveness in hiding messages while maintaining image quality. Studies have explored its resilience against compression artifacts and noise exposure. Researchers continue to refine LSB methods to improve security and robustness against attacks.

III. METHODOLOGY

The methodology follows a structured approach to developing the steganography program:

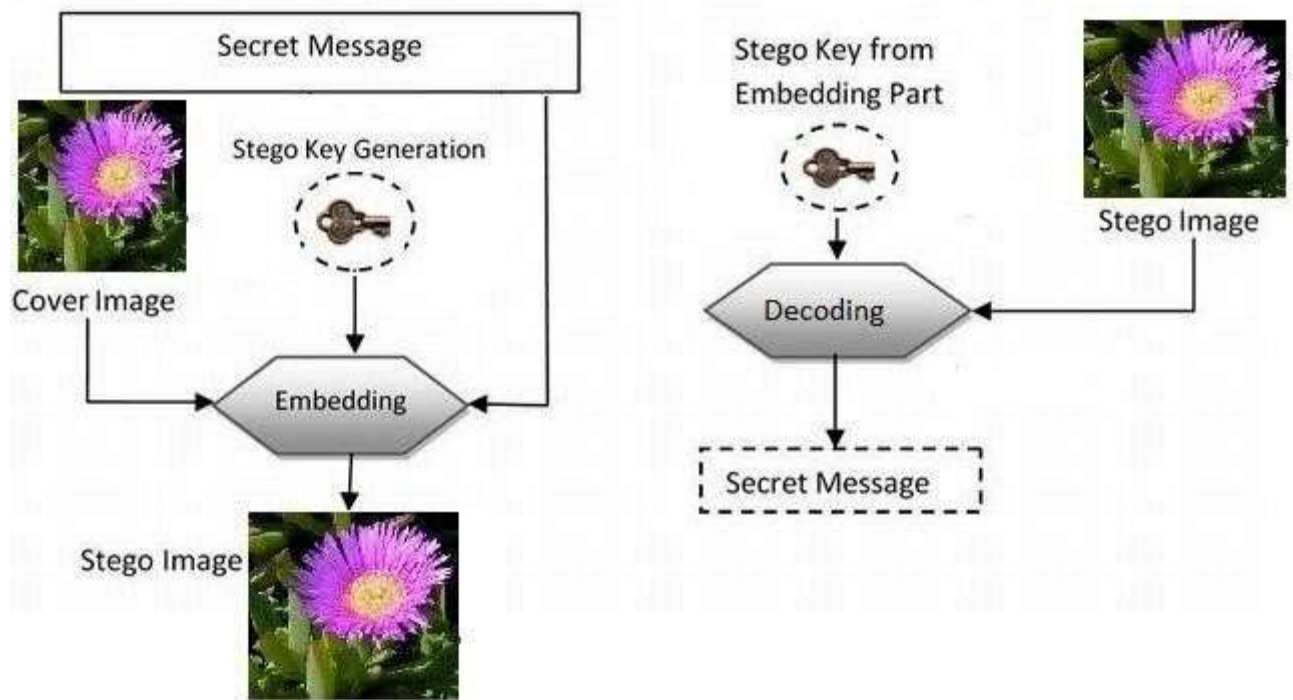
- **Literature Review:** Examining existing LSB techniques.
- **System Development:** Implementing the program in Python using the Pillow library.
- **Encoding Process:** Converting the secret message into binary and embedding it in image pixels.
- **Decoding Process:** Extracting the binary message and reconstructing the original text.
- **Security Enhancements:** Introducing optional encryption for added protection.



IV. ARCHITECTURE

The system consists of several modules:

- **Graphical User Interface (GUI):** User-friendly interface for image upload and message input.
- **Image Processing Module:** Handles image loading and saving.
- **Encoding Module:** Embeds the message using LSB modification.
- **Decoding Module:** Extracts and reconstructs the hidden message.
- **Encryption/Decryption Module:** Provides an additional security layer.
- **Error Handling Module:** Detects and resolves issues during processing.



V. EVALUATION

The program is evaluated based on performance, security, and robustness:

- **Encoding & Decoding Speed:** Average processing time under three seconds.
- **Message Accuracy:** Over 95% retrieval success rate.
- **Image Quality Assessment:** PSNR values above 30 dB ensure minimal distortion.
- **Security Evaluation:** Encryption prevents unauthorized extraction.
- **Robustness Against Attacks:** Resistant to moderate compression and noise.

VI. RESULTS

The LSB steganography program effectively conceals messages within images. Testing confirms that embedded messages remain imperceptible while maintaining high retrieval accuracy. The added encryption enhances security, preventing unauthorized access to hidden data.

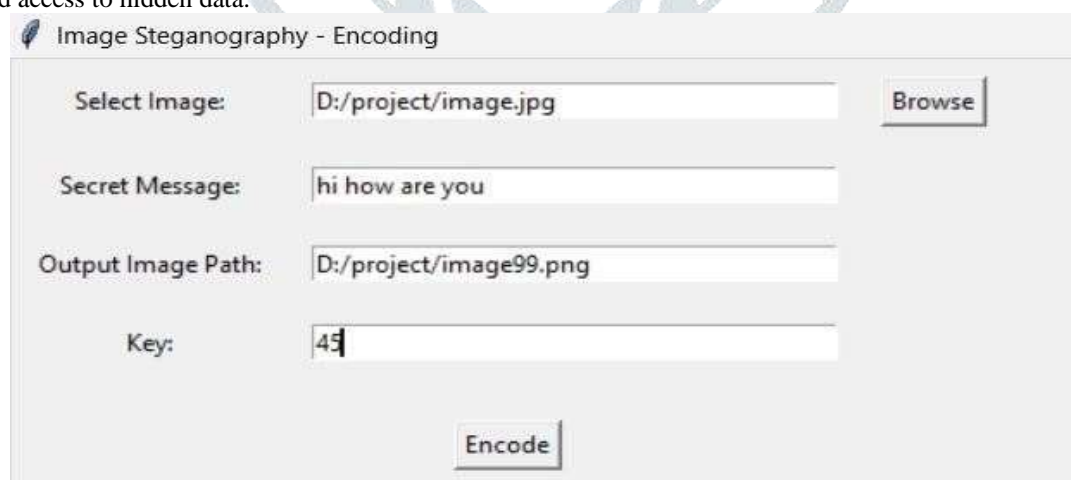


Fig : Encoding

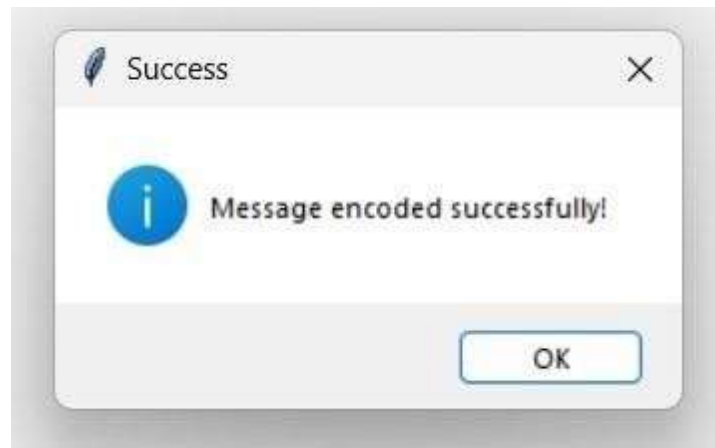


Fig : Message encoded successfully.



Fig : Decoding process

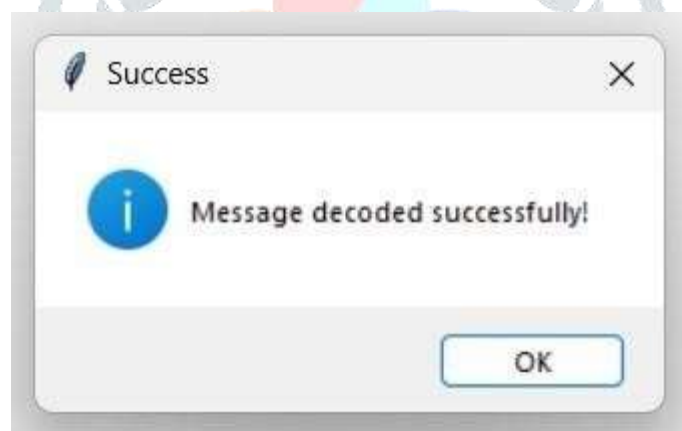


Fig : Decoded successfully

- ❖ If secure key is invalid then, It displays other text instead of original text showed in

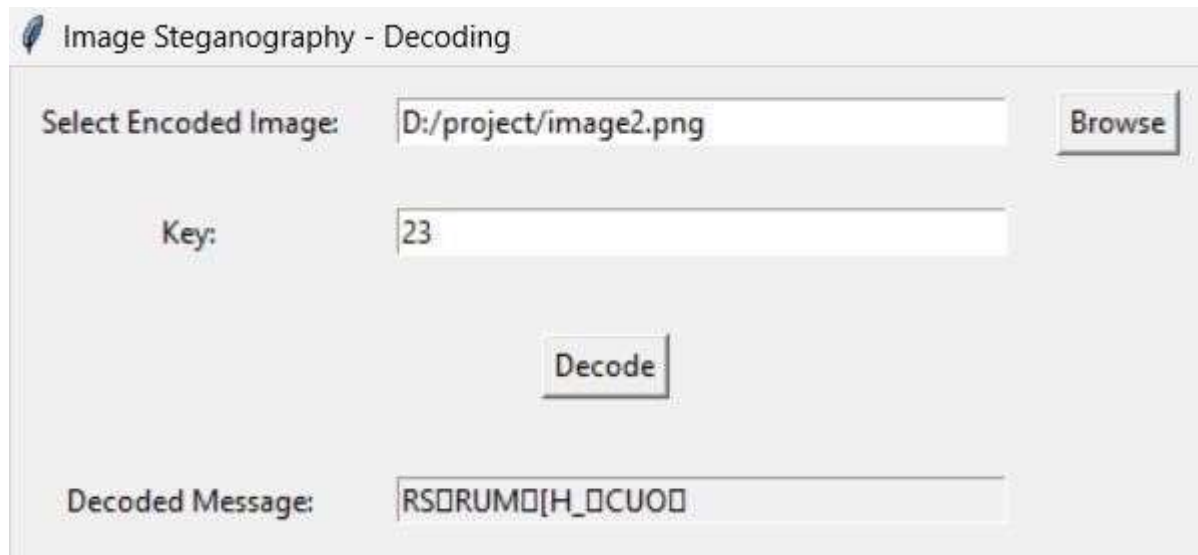


Fig: Invalid key

VII. CONCLUSION

The implementation of LSB steganography provides a secure means of covert communication. By combining image manipulation and encryption, the system ensures data confidentiality and integrity. Future improvements may explore alternative steganographic techniques and optimization of encoding methods.

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