**Project Report:**

**Image Steganography – Hiding Information in an Image**

**Project Title**

**Secure Communication using Image Steganography**

**Objective**

To implement a secure method of hiding text information within digital images using image steganography techniques, ensuring the confidentiality and integrity of data.

**Introduction**

Steganography is a method of concealing data within non-suspicious media—in this case, images. The Least Significant Bit (LSB) technique is one of the simplest and most effective methods for hiding messages in images without altering their visible quality.

**Tools & Technologies Used**

* **Language:** Python
* **Libraries:** PIL (Pillow), NumPy
* **IDE:** Jupyter Notebook / VS Code
* **Image Format:** PNG (preferred for lossless compression)

**Methodology**

* **Encoding:**
  + Convert the text message to binary.
  + Traverse through the pixels of the image.
  + Replace the least significant bit of each RGB channel with bits from the message.
  + Add a delimiter (1111111111111110) to mark the end of the hidden message.
* **Decoding:**
  + Read the least significant bits of the image.
  + Extract the binary data until the delimiter is found.
  + Convert the binary data back to text.

**Implementation**

Functions developed:

* encode\_image(): Embeds a secret message into an image.
* decode\_image(): Retrieves the hidden message from the image.

**Results**

* Successfully embedded and retrieved messages without compromising the image quality.
* The LSB method proved effective for short text-based data.

**Applications**

* Confidential data transmission
* Watermarking and copyright protection
* Authentication in digital systems

**Limitations**

* Limited message size based on image resolution.
* Vulnerable to image compression and modifications.
* No built-in encryption (can be added for stronger security).

**Conclusion**

This project demonstrates how steganography can be implemented using Python to securely transmit hidden messages in digital images. It reinforces concepts of cybersecurity, data privacy, and digital image processing.