

Steganography Project — Hiding Information in Plain Sight

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Environment: Kali Linux (CLI-based)

Project link: <https://github.com/OluwaseunOa/Cyber-Security-Projects/tree/main/Cyber-Security-Fundamentals/Steganography-Project>

1. Project Overview

This project demonstrates the process of **digital steganography** — hiding information within a seemingly normal file — using **Steghide**. For this demonstration, a Linux Debian-based distribution called **Kali Linux** was used.

We embed a text file (**secret.txt**) into a JPEG image (**cover.jpeg**) without changing the visible appearance of the image. The hidden message can only be retrieved with the correct passphrase.

Key Objectives:

- Show how Steghide can hide a file inside an image.
 - Verify that the stego image looks identical to the original.
 - Extract the hidden message to confirm successful embedding.
 - Discuss security implications and ethical considerations.
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2. Folder Structure

```
Steganography-Project/
|
├── cover.jpeg           # Carrier image
├── secret.txt           # File to be hidden
├── img/                 # Screenshots of the process
│   ├── 1.project_folder_on_cli.png
│   ├── 2.project_folder_in_gui.png
│   ├── 3.open_secret-txt.png
│   ├── 4.stat_secret-txt_before_steg.png
│   ├── 5.open_cover-jpeg.png
│   ├── 6.stat_cover-jpeg.png
│   ├── 7.steg_command.png
│   ├── 8.steg-jpg_creation_confirmed_cli.png
│   ├── 9.steg-jpg_creation_confirmed_gui.png
│   ├── 10.open_stego-jpg.png
│   ├── 11.compare_size_and_hash_digest_of_cover-jpeg_with_stego-jpeg.png
│   ├── 13.navigate_to_new_the_STEGO_FOLDER.png
│   ├── 11.compare_size_of_cover-jpeg_with_stego-jpeg.png
│   └── 12.move_stego-jpg_to_new_subfolder.png
```

```
|   └─ 13.navigate_to_new_the_STEGO_FOLDER.png
|   └─ 14.extract_stego-jpg.png
└─ STEGO_FOLDER      # Output folder for stego image & extracted files
└─ README.md         # Project documentation file
```

3. Tools Used

- **Kali Linux** (pre-installed with Steghide)
- **Steghide** (command-line steganography tool)
- Basic Linux utilities (`ls`, `stat`, `cat`)

Verify Steghide is installed:

```
steghide --version
```

4. Step-by-Step Implementation

Step 1 — Navigate to Project Folder to see the starting files (CLI)

```
cd ~/Desktop/Cyber-Security-Projects/Cyber-Security-Fundamentals/Steganography-Project
ls
tree
```


 Project Folder in CLI

Step 2 — Confirm Files in GUI

 Project Folder in GUI


Step 3 — Open `secret.txt` in nano

```
nano secret.txt
```

 Open secret.txt

Step 4 — Check Properties of `secret.txt`

```
stat secret.txt
```

 Stat secret.txt

Step 5 — Open `cover.jpeg`

 Open cover.jpeg

Step 6 — Check Properties of `cover.jpeg`

```
stat cover.jpeg
```

 Stat cover.jpeg

Step 7 — Embed `secret.txt` Inside `cover.jpeg`

```
steghide embed -cf cover.jpeg -ef secret.txt -sf stego.jpg
```

- `-cf`: cover file (image)
- `-ef`: embedded file (secret)
- You will be prompted for a **passphrase**. Remember it for extraction.

 Steg Command

Step 8 — Confirm Stego Image Creation (CLI)


```
ls
```

 Stego Creation CLI

Step 9 — Confirm Stego Image Creation (GUI)

 Stego Creation GUI

Step 10 — Open Stego Image

Visually inspect — no difference from original.  Open Stego JPEG

Step 11 — Compare Sizes and File Hash Digest for cover.jpeg and stego.jpg

```
stat cover.jpeg
sha256sum cover.jpeg
```

```
stat stego.jpg
sha256sum stego.jpg
```



Compare Sizes

Expected Output:

```
File: cover.jpeg
Size: 3010 bytes
SHA256sum Hash: c0b3b45c11546813d8f08de9b2e1606bc92e8f6d4b5b84228ce0da32f0effb1b
```

```
File: stego.jpg
Size: 3672 bytes
SHA256sum Hash:
19ae28125a85e6146c5043aada45fcdbab24662dff1e46e1587df6c0af5c8726
```

Observe that the size and hash values are different, indicating that stego.jpg has been modified to contain hidden data.

Step 12 – Organize the stego file for extraction

I created a **STEGO_FOLDER** for better file management, moved **stego.jpg** into it, and used the **tree** command in **Steganography-Project** directory to confirm its new location in preparation for extraction.

Commands used:

```
mkdir STEGO_FOLDER
mv stego.jpg ./STEGO_FOLDER
tree
```

Expected output:

```
Steganography-Project
├─ README.md
├─ original.jpg
```

```
├─ secret.txt
├─ STEGO_FOLDER
│   └─ stego.jpg
```

 Output Folder

Step 13 — Navigated STEGO_FOLDER to extract Hidden Message

```
# from Steganography-Project to STEGO_FOLDER
```

```
cd STEGO_FOLDER
```

```
#Extract stego.jpg file
```

```
steghide extract -sf stego.jpg
```

- **-sf**: stego file
- Enter the passphrase used during embedding.
- **secret.txt** will be recovered in the current directory.

 Extract Stego JPEG

5. Observations

- Stego image **looks identical** to original, but file size is slightly larger.
- Without the correct passphrase, the secret cannot be extracted.
- Steghide automatically encrypts the embedded file for extra security.

6. Ethical Considerations

Steganography is a powerful tool but can be abused. **Legitimate uses:**

- Secure communication in hostile environments.
- Watermarking and copyright protection.

Risks:

- Concealing malicious payloads.
- Evading digital forensics.

7. References

- [Steghide Documentation](#)

- Provos, N., & Honeyman, P. (2003). *Hide and Seek: An Introduction to Steganography*. IEEE Security & Privacy.