CAPSTONE PROJECT

SECURE DATA HIDING IN IMAGES USING STEGANOGRAPHY

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OUTLINE

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PROBLEM STATEMENT

- With the rise of digital communication, securing sensitive data has become crucial.
- Traditional encryption methods are effective but often raise suspicion.
- Steganography provides a means to **hide information within images** in a way that is undetectable to the human eye, ensuring **covert data transmission**.
- However, existing steganography solutions lack **user-friendly interfaces**, **strong password protection**, and **web-based accessibility**.
- This project addresses these issues by developing a **secure, intuitive, and efficient image steganography tool**.

TECHNOLOGY USED

- **Frontend:**
- **HTML, CSS (Dark/Light theme), JavaScript** – Interactive and accessible UI with theme toggling.
- **Backend:**
- **Python (Flask)** – Handles encoding/decoding logic and user interactions.
- **Data Handling:**
- **OpenCV** – Image processing for steganographic encoding/decoding.
- **Pillow (PIL)** – Image format handling and manipulation.
- **Security:**
- **AES Encryption** – Ensures password-protected encoding and decoding.
- **Salted Hashing** – Used for securely storing passwords.

- **Storage:**
- **File-based system** – Temporary storage for uploaded and processed images (can be extended to cloud storage).
- **Deployment:**
- **Docker** – Containerized deployment for consistency across environments.
- **Google Cloud Run** – Serverless hosting for scalability and accessibility.

WOW FACTORS

✨ Interactive UI with Dark Mode & Theme Toggle

✨ Real-time Image Preview for selected images before encoding/decoding

✨ Password-Protected Encoding & Decoding for enhanced security

✨ Expanding Magic Smiley Animation in UI for an engaging experience

✨ Potential for Future AI-based Steganalysis Detection Countermeasures

END USERS

👩‍💻 **Cybersecurity Professionals** – Securely transmit sensitive data

📧 **Journalists & Activists** – Share confidential information under censorship

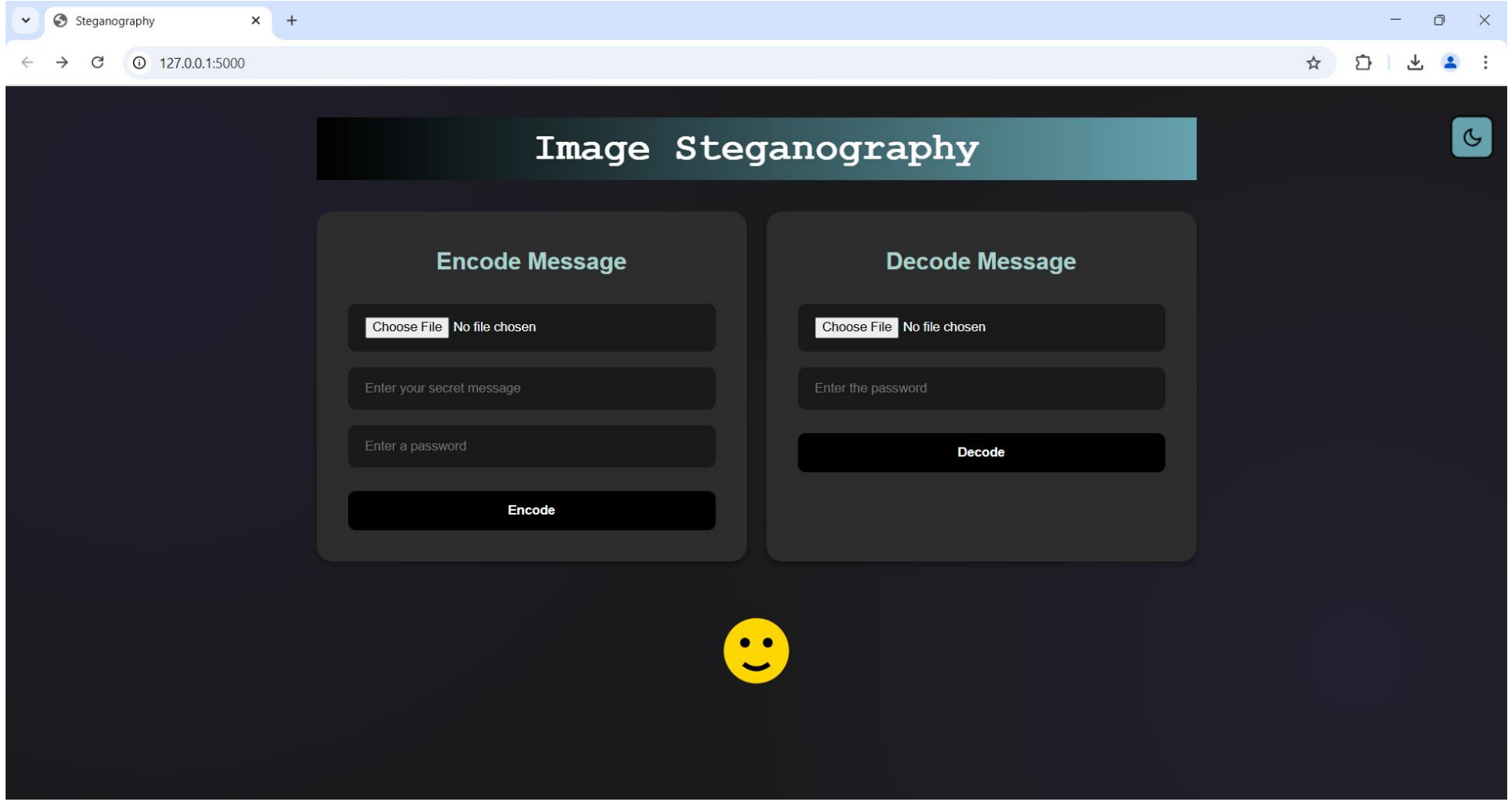
🔐 **Privacy Enthusiasts** – Hide personal notes or data in images

🎨 **Digital Artists** – Conceal copyright information or easter eggs in art

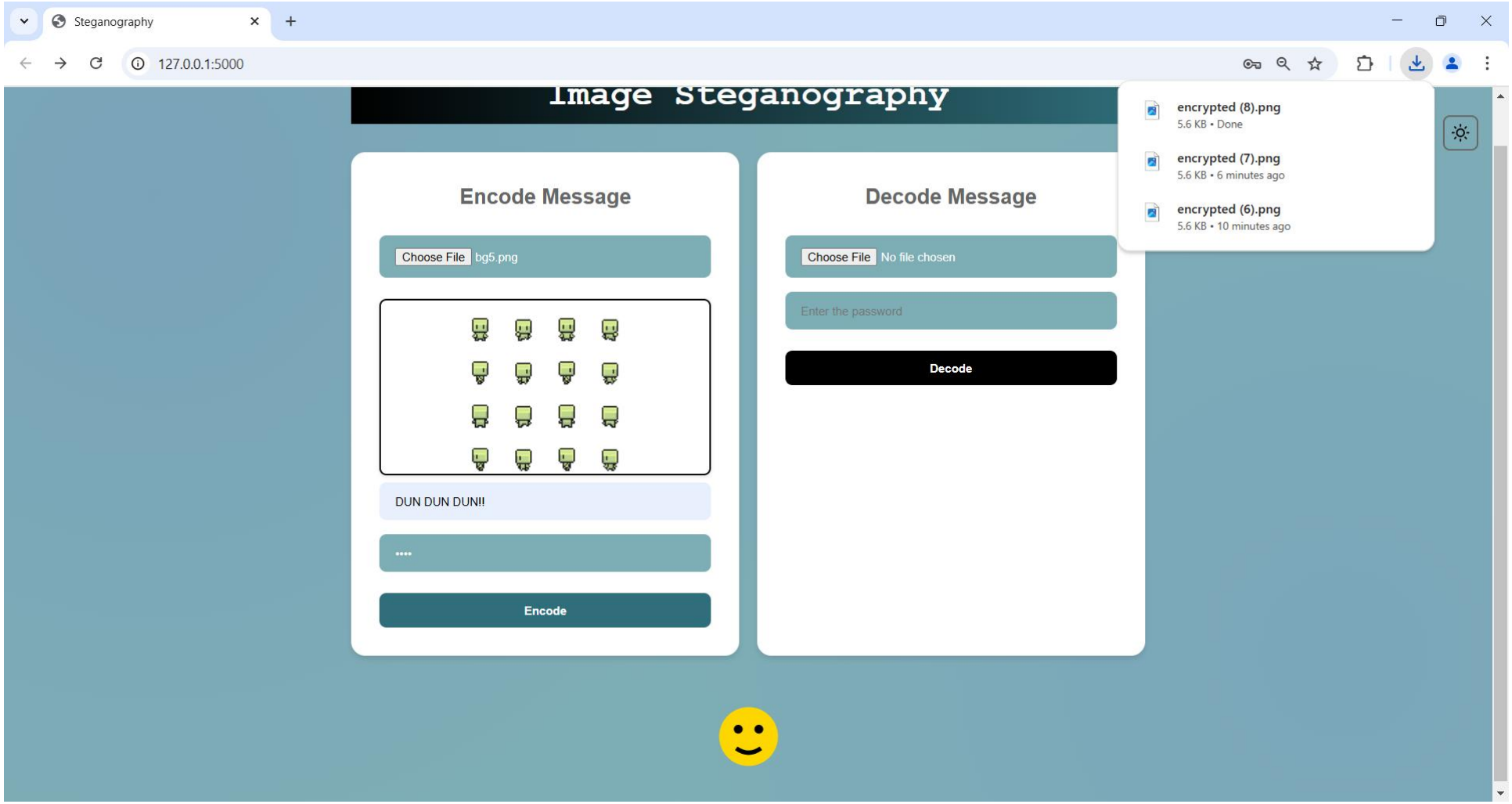
🏢 **Corporations** – Secure internal communication without suspicion

RESULTS

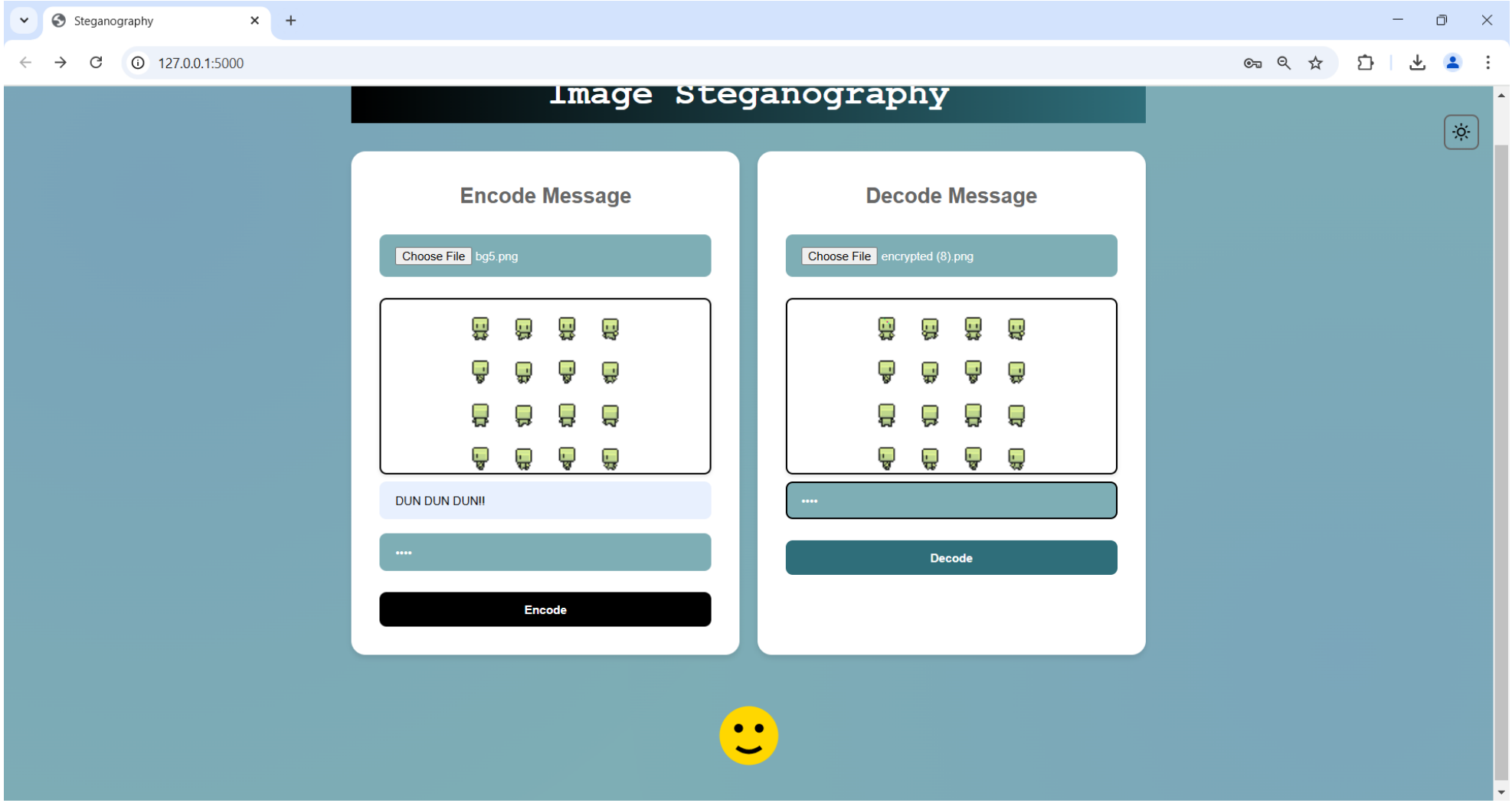
LIGHT/DARK THEME:



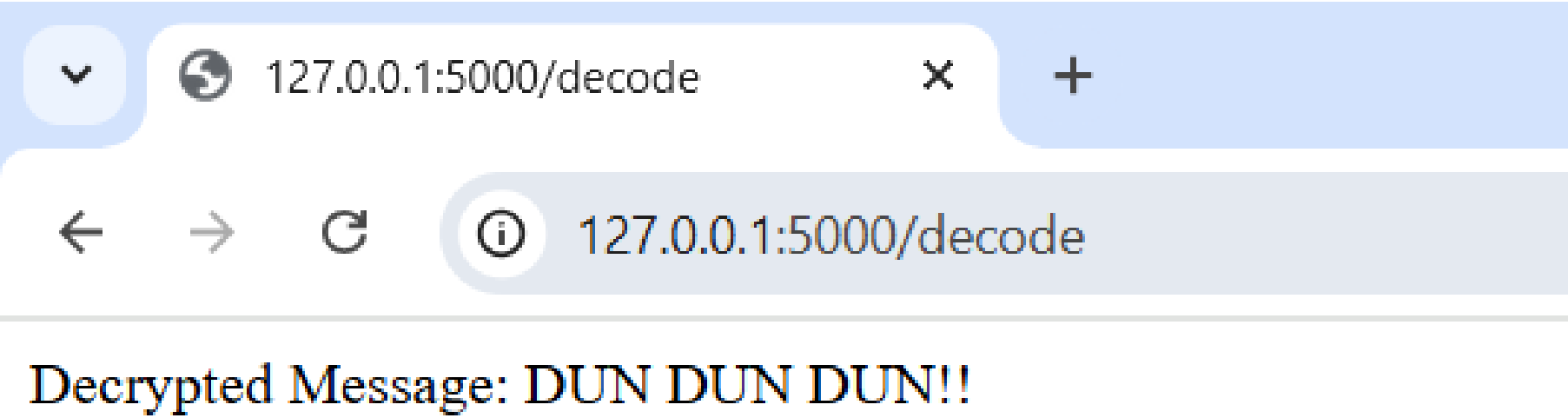
ENCODE:


Steganography
127.0.0.1:5000
Image Steganography
encrypted (8).png
5.6 KB • Done
encrypted (7).png
5.6 KB • 6 minutes ago
encrypted (6).png
5.6 KB • 10 minutes ago
Encode Message
Choose File bg5.png
DUN DUN DUN!!
Encode
Decode Message
Choose File No file chosen
Enter the password
Decode

DECODE:



OUTPUT:


127.0.0.1:5000/decode
127.0.0.1:5000/decode
Decrypted Message: DUN DUN DUN!!

CONCLUSION

- This project provides a modern, intuitive, and secure solution for digital steganography.
- By combining image processing, encryption, and a user-friendly UI, it enhances data security while remaining accessible.
- With future improvements like cloud storage, AI-driven security enhancements, and mobile integration, it can become a mainstream solution for private communication.

LINKS

GitHub Link:

- https://github.com/AditriRay/Steganography

Service URL:

- https://steg-aditri-ibmskillsbuild-999019699834.asia-south1.run.app

FUTURE SCOPE(OPTIONAL)

- Implement more advanced encryption techniques like AES with steganography.
- Support larger file types beyond images (e.g., audio, video).
- Mobile & Cloud Integration: Develop a mobile app with steganography-based messaging.
- Enable cloud storage for encoded images for remote access.
- AI-Powered Steganography: Use machine learning to adaptively hide messages in different image regions.
- Detect and counter steganalysis techniques that try to crack hidden messages.

CONCEPT:

- A cryptic website where players solve a hidden puzzle by uncovering secret messages embedded in images.
- Players upload images they find throughout the game, and the system decodes hidden clues.
- Some images might require passwords (found through riddles in previous levels).
- Completing a challenge unlocks new encrypted messages or levels.
- Aesthetic: A dark, cyberpunk-themed interface with glowing text and glitch effects.
- Multi-player Mode: Players can hide messages inside images and challenge friends to decrypt them.

THANK YOU!

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