PROJECT REPORT

ON

CipherPic

Submitted to

NMAM INSTITUTE OF TECHNOLOGY, NITTE

(Off-Campus Centre, Nitte Deemed to be University, Nitte - 574 110, Karnataka, India)

In partial fulfilment of the requirements for the award of the Degree

of Bachelor of Technology

in

INFORMATION SCIENCE AND ENGINEERING

by

RITHESH

NNM22IS130

Under the guidance of

Dr. Jason Elroy Martis

Associate Professor

NITTE (Deemed to be University) | NMAM INSTITUTE OF TECHNOLOGY

2024 - 2025

NITTE (Deemed to be University) | NMAM INSTITUTE OF TECHNOLOGY

Department of Information Science & Engineering

CERTIFICATE

This is to certify that Mr. Rithesh (NNM22IS130) of III-year B.Tech., a Bonafide students of NMAM Institute of Technology, Nitte has carried out project on "**CipherPic**" As a part of **Information & Network Security** (IS4001-1) course During 2024-25, fulfilling the partial requirements for the award of Degree of Bachelor of Technology in Information science and Engineering at NMAM Institute of Technology, Nitte.

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Signature of Course Instructor

Dr. Jason Elroy Martis

Associate Professor,

Department of ISE, NMAMIT, NITTE

ACKNOWLEDGMENT

By doing this project, I got hands-on experience and learned a lot about secure data handling, encryption techniques, and the development of secure desktop applications. It has been a highly enriching learning journey

First of all, I thank my project guide Dr. Jason Elroy Martis Associate Professor, Department of ISE for his continuous guidance throughout the project. He is always helping me in my work by suggesting and guiding me all through the completion of the task. The project work was done as a part of the coursework for the subject Information & Network Security, and the provides a key role in project work.

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ABSTRACT

As everyone is going digital the need to secure sensitive images has become crucial. CipherPic is a desktop application that is cross-platform which provides an easy way to encrypt and decrypt images. CipherPic is an Electron-based cross-platform desktop application that enables a user-friendly experience for image encryption/decryption using advanced image encryption algorithms. Furthermore, it is designed using modern web technologies (i.e. HTML, CSS, JavaScript) and high-performance Node.js modules. Also, the software performs encryption/decryption with a simple click of a button through the user-friendly GUI. Thus, we arrive at an effective encryption/decryption tool which is accessible for everyone.

The software lets you encrypt images with a key using **[1]** XOR encryption which is implemented using Jimp image processing library. We use one key for every single pixel processed for the encryption along with saving it separately for security and reversibility. To retrieve the original image, the corresponding key file is needed to decrypt the image.

All operations regarding encryption, decryption and exchange of information between front and back ends are done using modular JavaScript files. Utilizing Electron, the app runs native on Windows, macOS and Linux without the need for any external software or command line tools.

CipherPic is a software project for the local handling of pictures that enables encrypting an image locally in the device itself, thus removing any risks involved in doing so over the cloud. This app provides an easy and effective way to protect images, offering a solution for secure data storage for personal and professional use.

PROBLEM STATEMENT

As digital data transfer increasingly takes place, image files are frequently shared with sensitive payloads that may be at risk for accidental access by unintended parties. The current encryption software tools available today are often either excessively complex for the general user or require cloud services, with inherent privacy concerns associated with sharing the image file themselves with a third-party. There is a need for an easy to use and standalone desktop application that will allow easy-to-use encryption and decryption of images.

OBJECTIVES

The primary objectives of this project are as follows:

- To provide a solution for secure data handling, specifically focusing on secure image file storage through encryption and decryption techniques.
- To develop a user-friendly desktop application for image encryption and decryption using Electron.
- To implement efficient image processing using the Jimp library and a key-based XOR encryption method. [1]
- To offer a minimal, intuitive graphical interface suitable for both technical and non-technical users.

METHODOLOGY

The project involves building a secure image encryption and decryption desktop application using Electron. The application is platform-independent and accessible, allowing users to secure confidential image files through a key-based encryption process. The pixel-level encryption and decryption are done using an XOR operation through the Jimp library. [1] The graphical interface of the application is built using the web technologies i.e. HTML, CSS, and JavaScript. The logic, on the other hand, is developed using Node.js modules as well as IPC (inter-process communication) mechanisms of Electron.

The process in the methodology are listed as follows:

1. **GUI Development:**

   HTML, CSS and JavaScript are used to create a simple and interactive GUI. The user interface contains image file choose button, encrypt/decrypt button and output file save button.

2. **Image Encryption**

   "We use a library called Jimp to load the image. We can then analyse and manipulate every pixel in the image by extracting its RGB properties. We will apply the XOR logic on all pixels using a randomly generated key". [1] The image that has been encrypted as well as the key file is saved separately.

3. **Image Decryption**

   Decrypting the picture was easy. If anyone knows the key, they can decrypt it easily without any issues. The user can choose where to save the decrypted output.

4. **IPC Integration**

   IPC (Inter-Process Communication) is used by Electron to enable communication between the frontend and backend. This connects what the user does in the GUI to the backend logic in Node.js files.

5. **Application Packaging**

   Once development was done, I packaged the application using Electron Forge to create its executable for a particular platform. After this stage, the users of the application will no longer need to run Node.js on their own.

6. **User Interface**

   To enhance the accessibility of the project's results, we developed a user-friendly interface using electron. The user interface allows users to interactively encrypt and decrypt image files conveniently.

   Key functionalities include:

   - Users can select any image files to encrypt or decrypt these using native file dialogs.
   - The program on encryption generates and saves automatically, a key to be used later in decryption which can be selected.
   - Users can select the location and name of the output of the encrypted or decrypted image files in the output file customization.
   - The desktop application is packaged to operate on different operating systems. So, there is no need to have command-line knowledge.

RESULTS

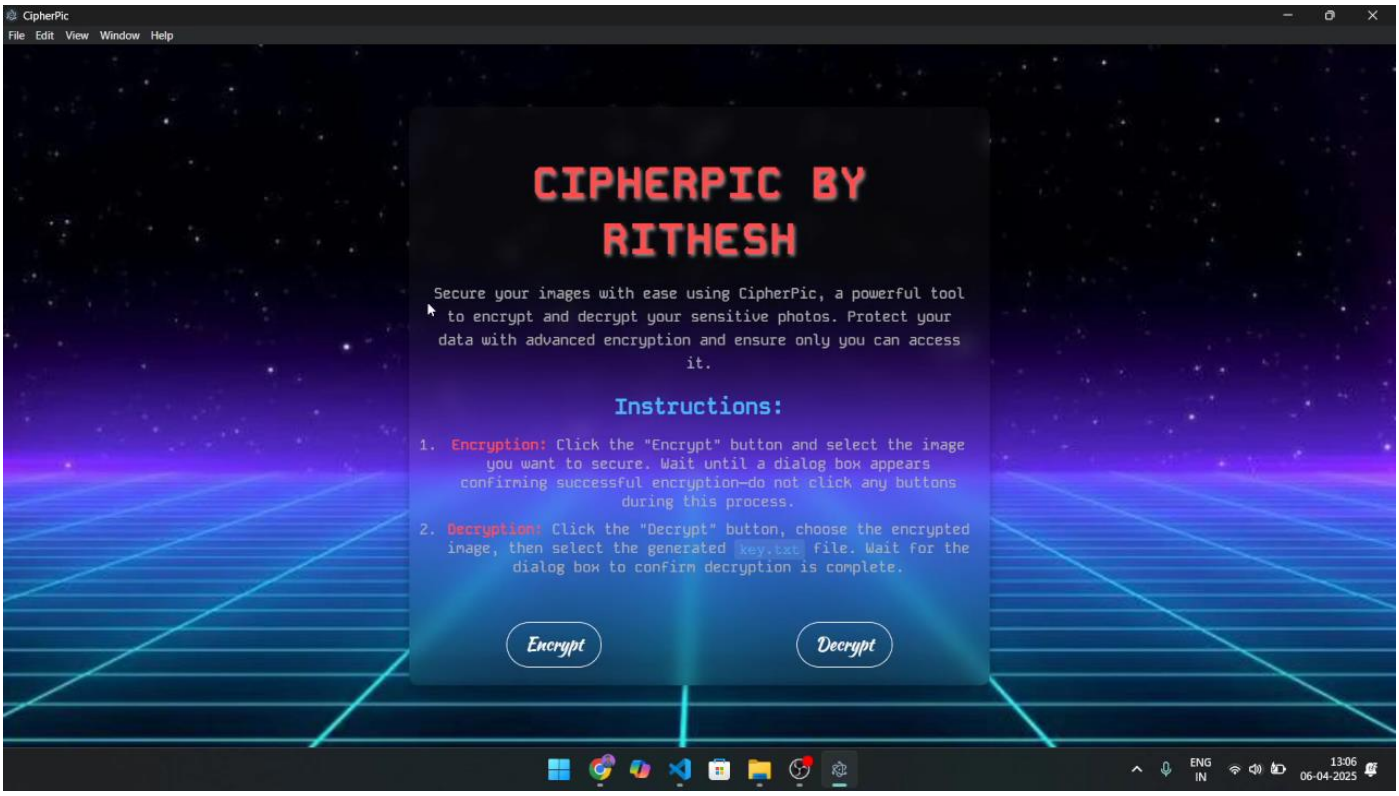

Fig 1: The CipherPic User Interface

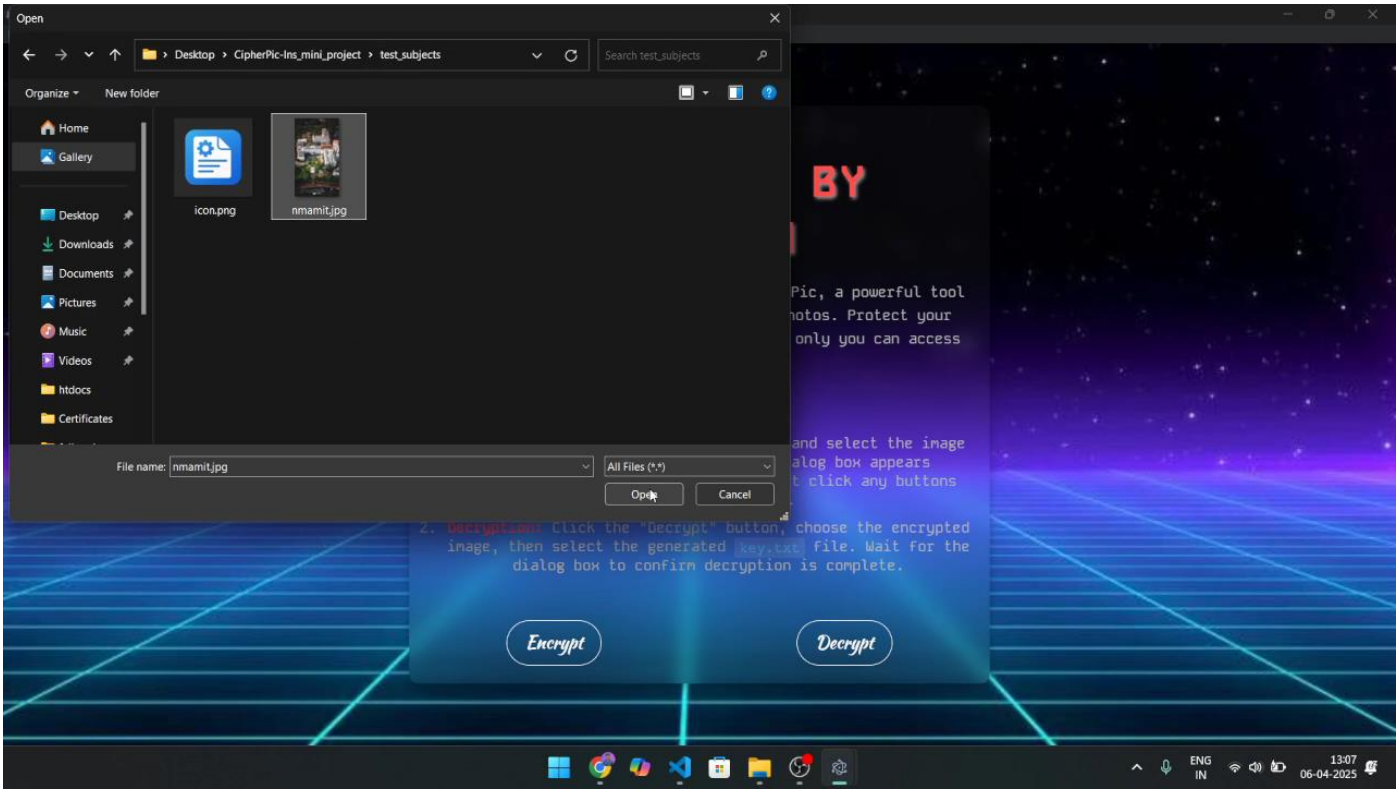

Fig 2: Selecting Image for Encryption

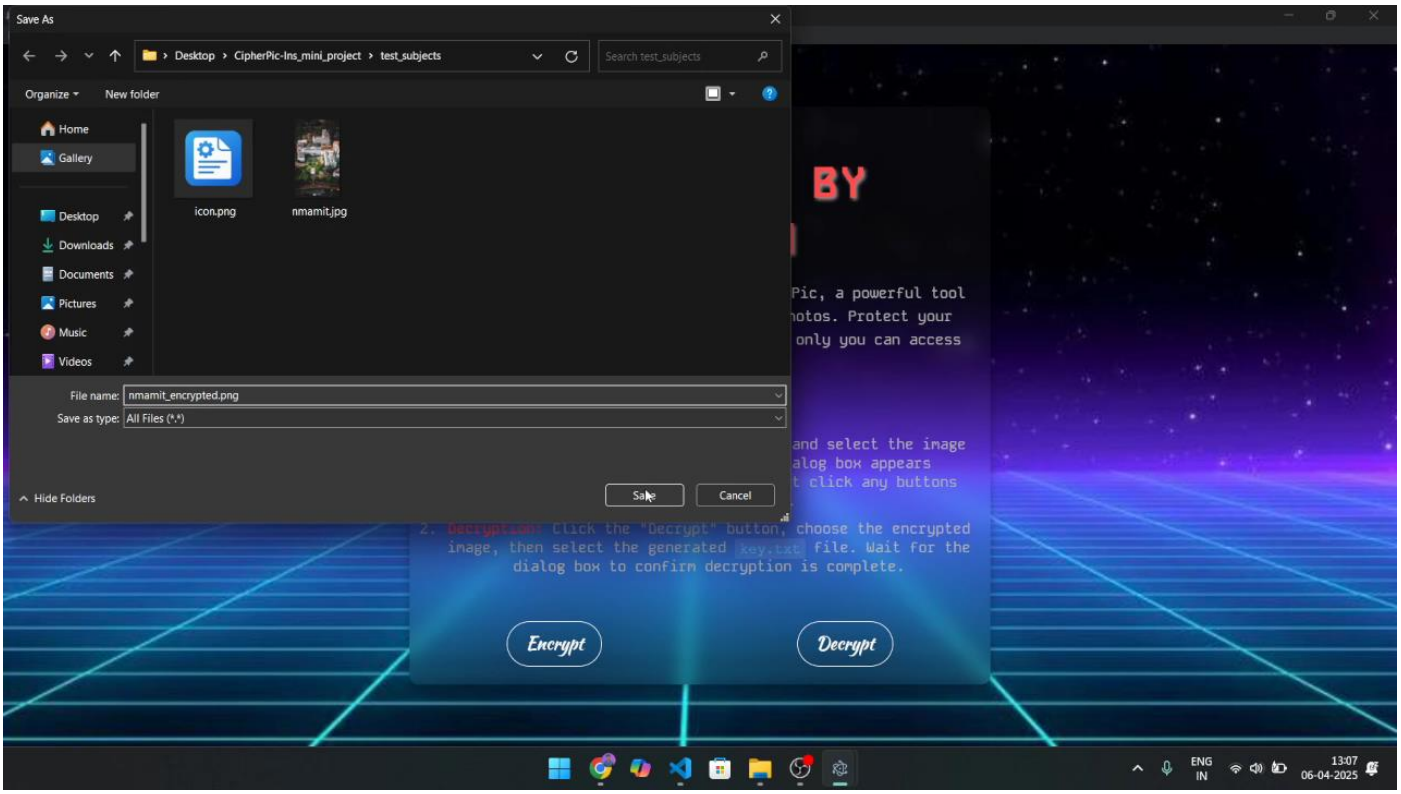

Fig 3: Location for Saving the Encrypted Image

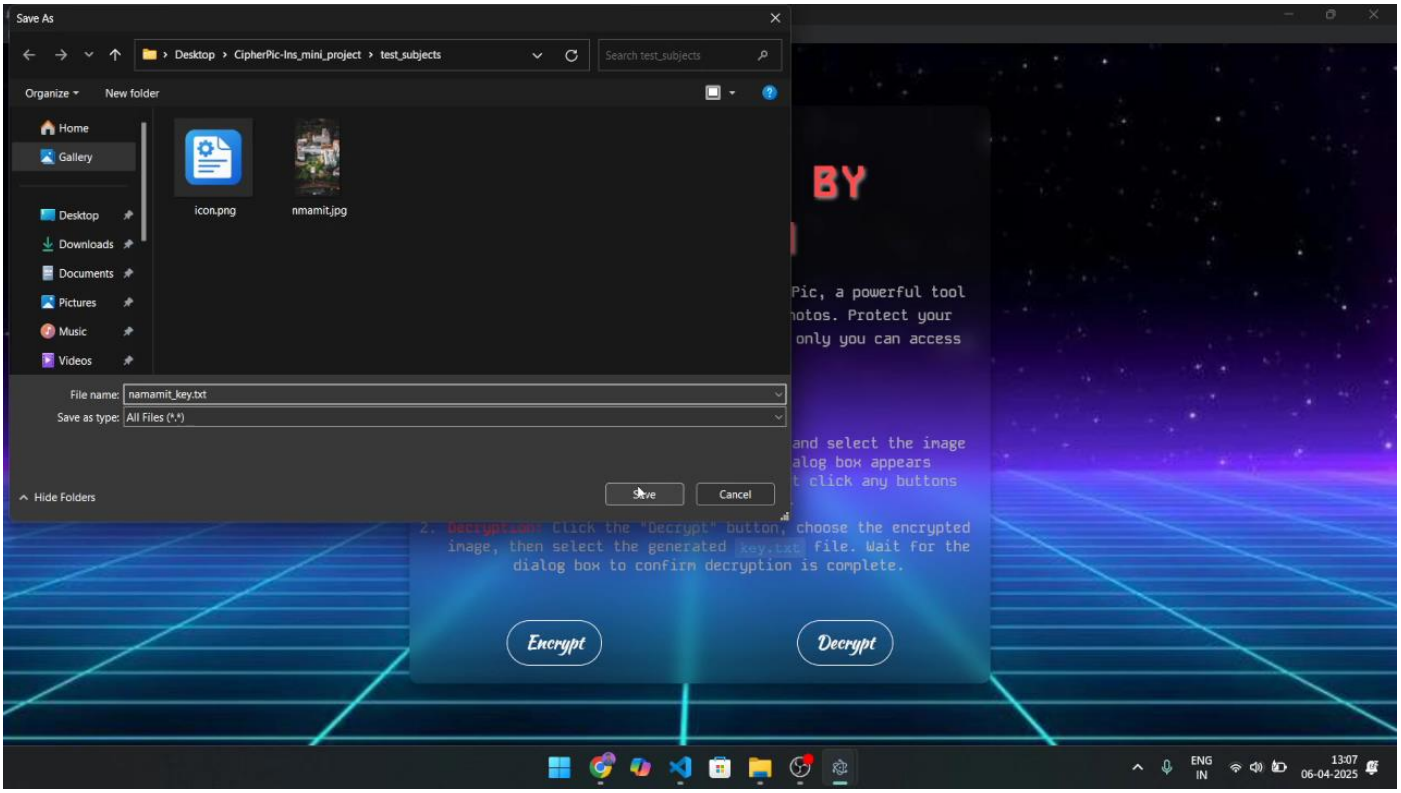

Fig 4: Location for Saving the Key.txt

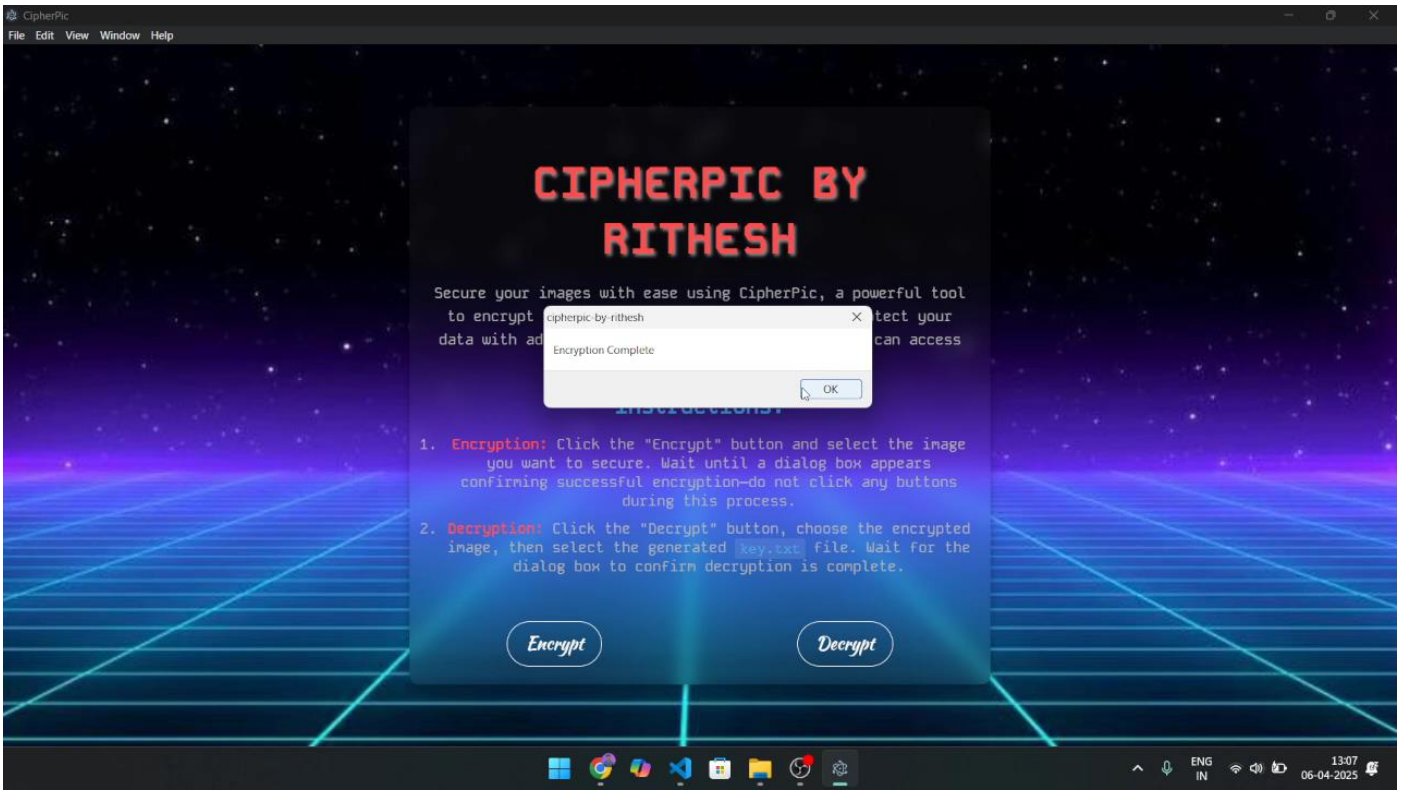

Fig 5: Encryption Completed

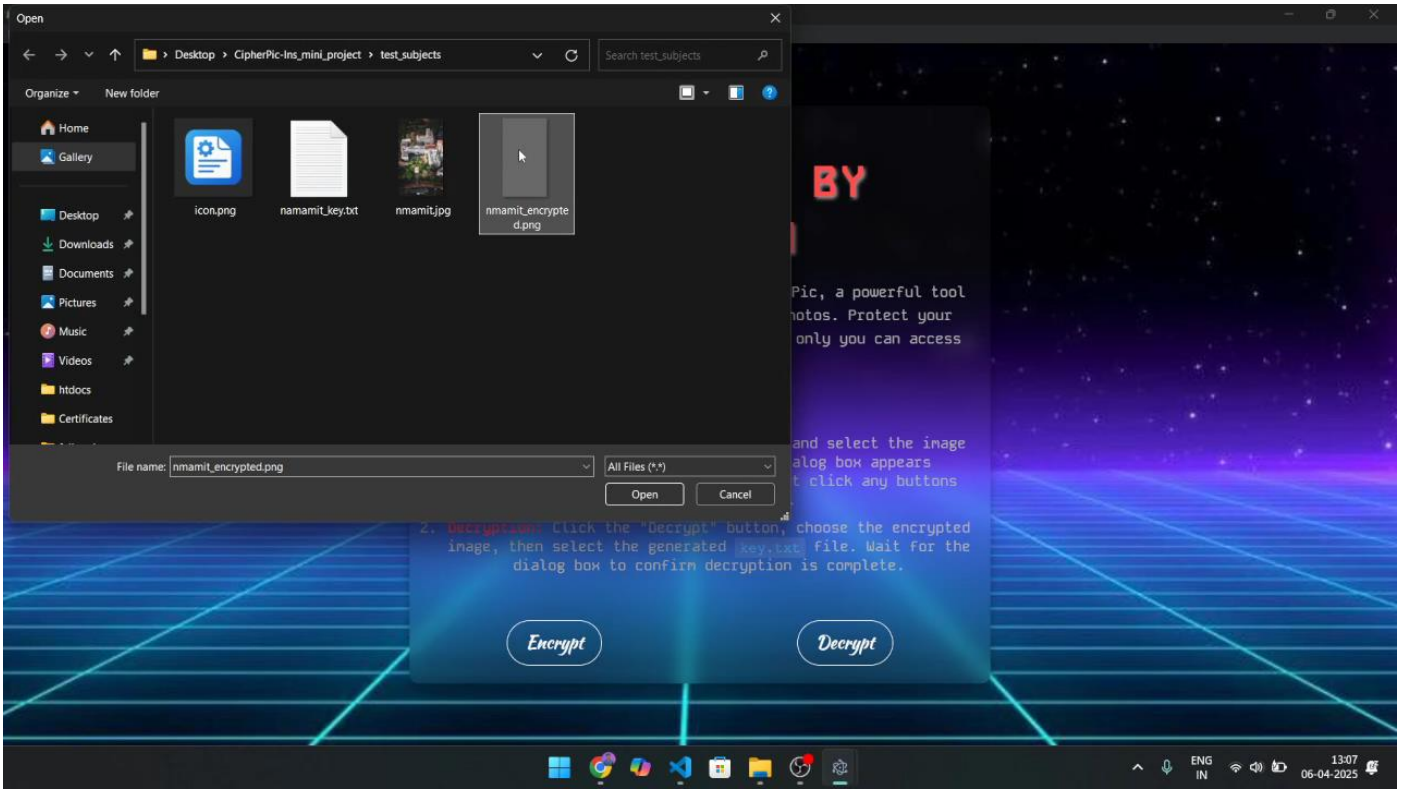

Fig 6: Selecting the Encrypted image for Decryptio

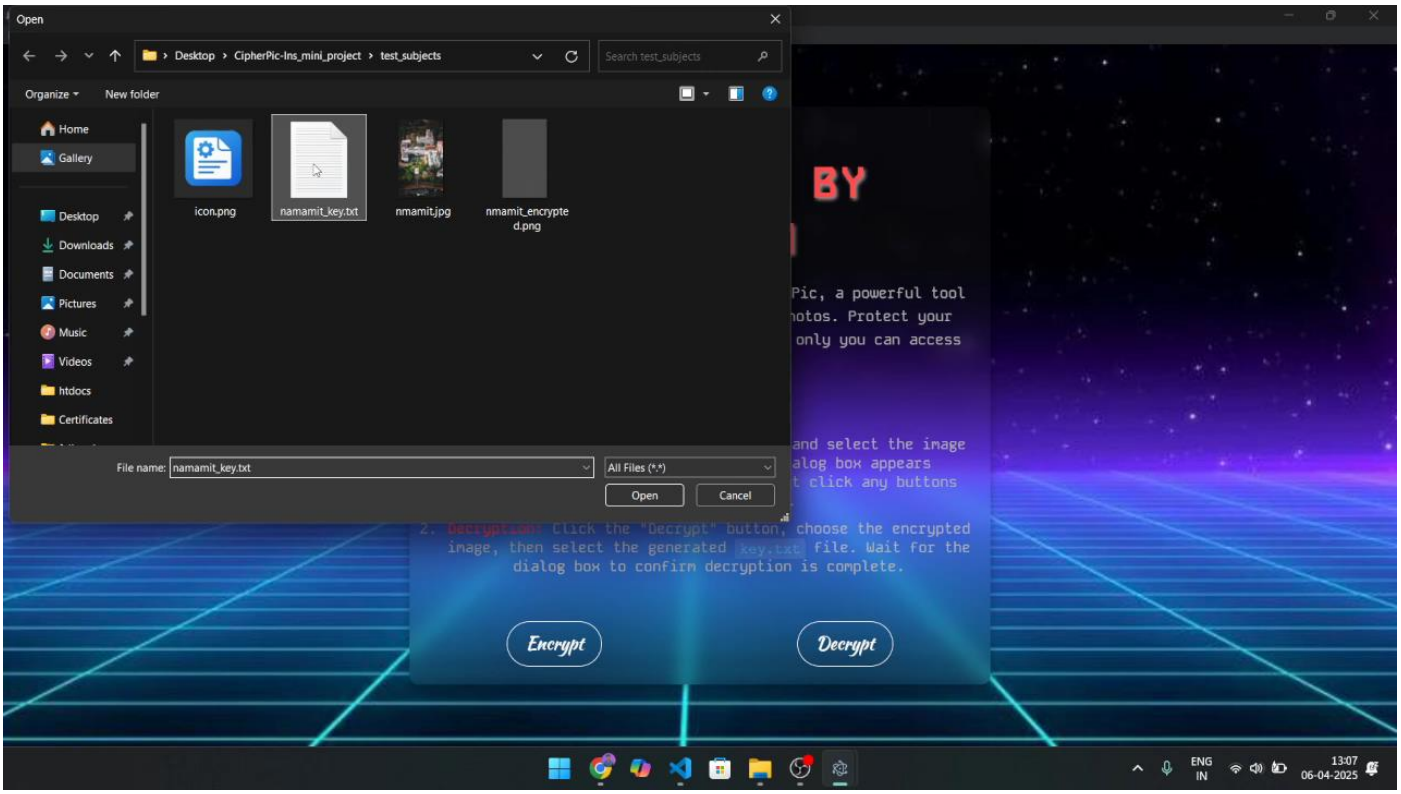

Fig 7: Selecting the Key.txt for Decryption process

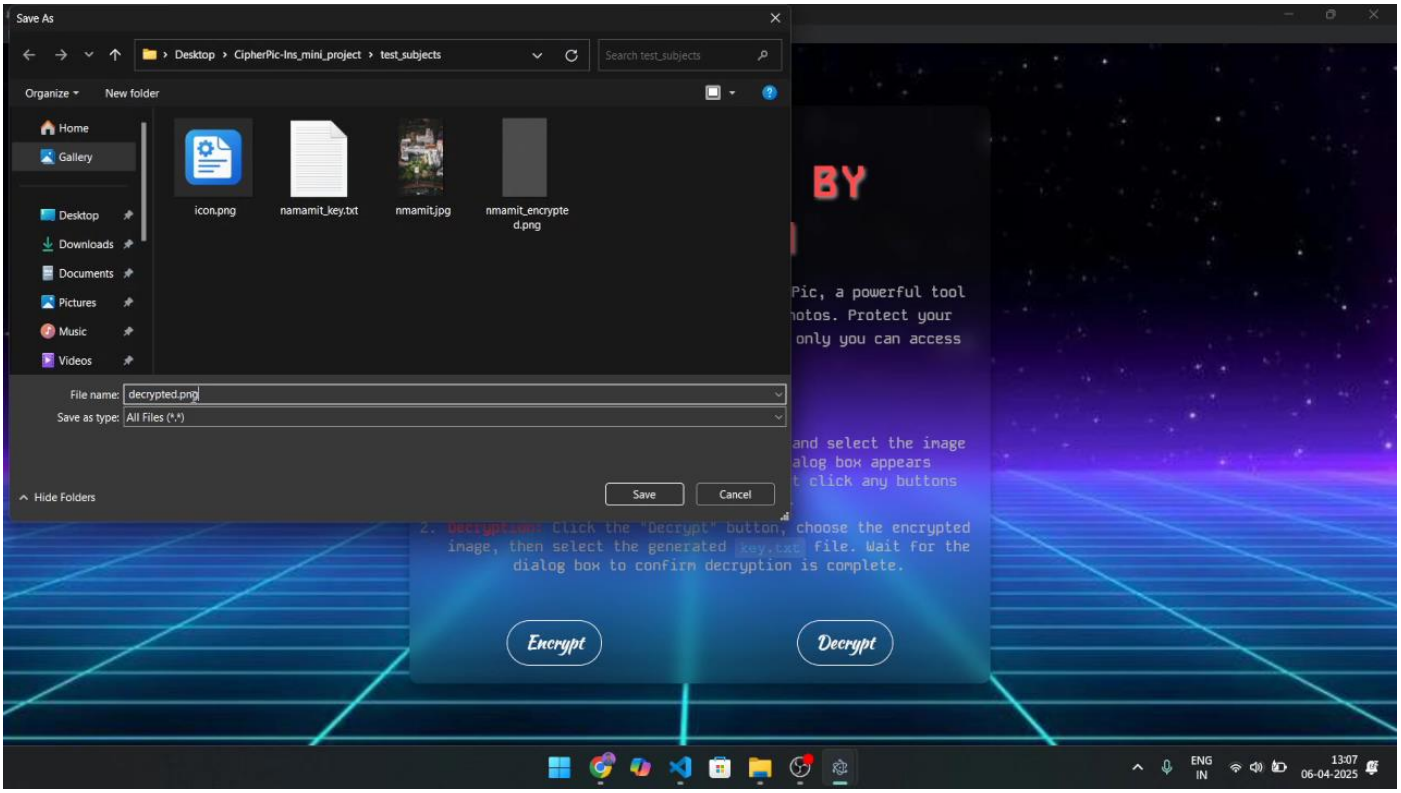

Fig 8: Saving the Decrypted image

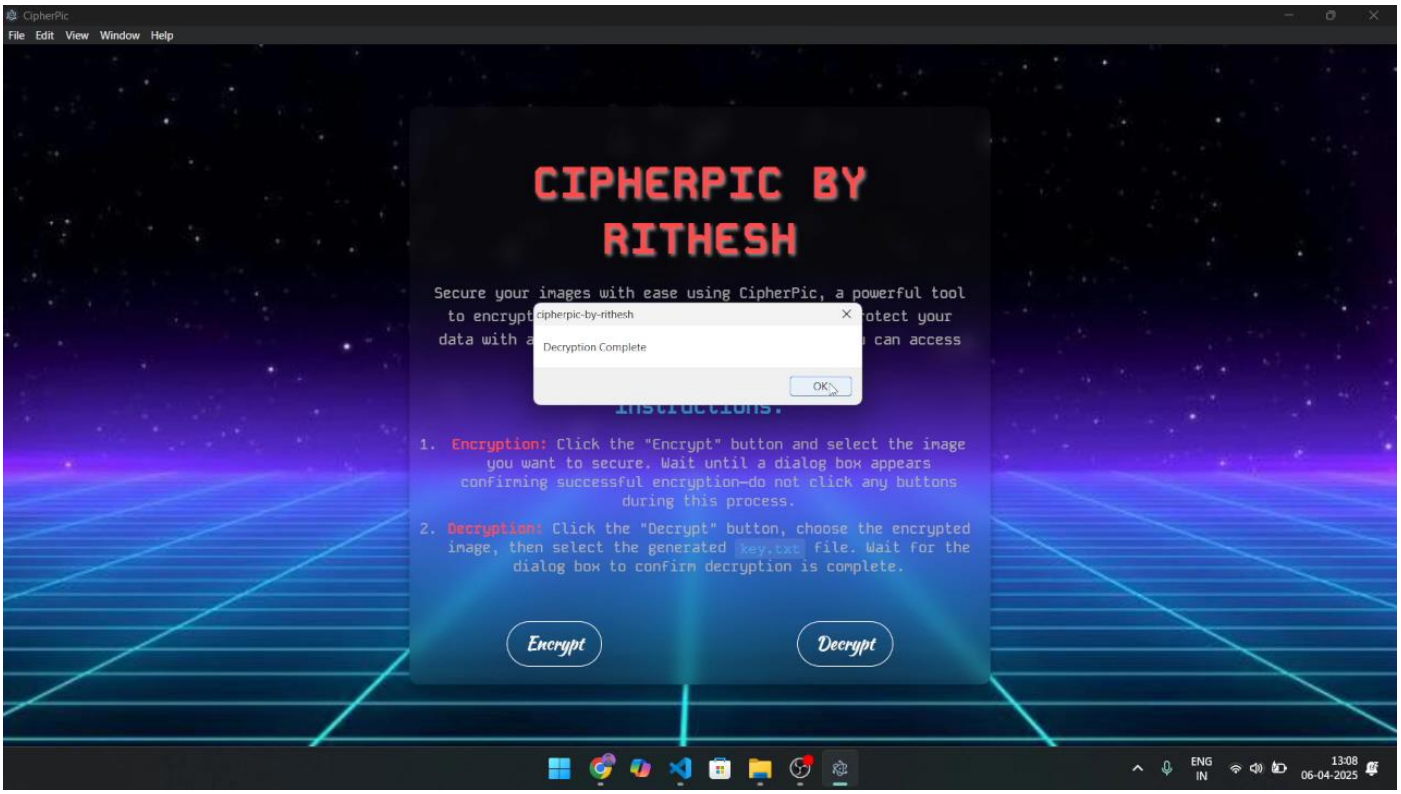

Fig 9: Decryption completed dialog

Fig 10: image before Encryption

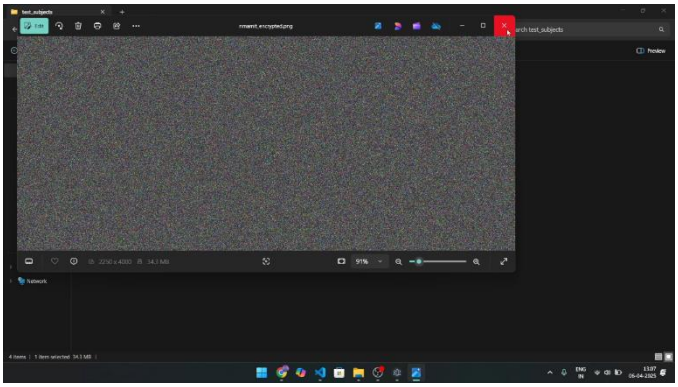

Fig 11: image after Encryption

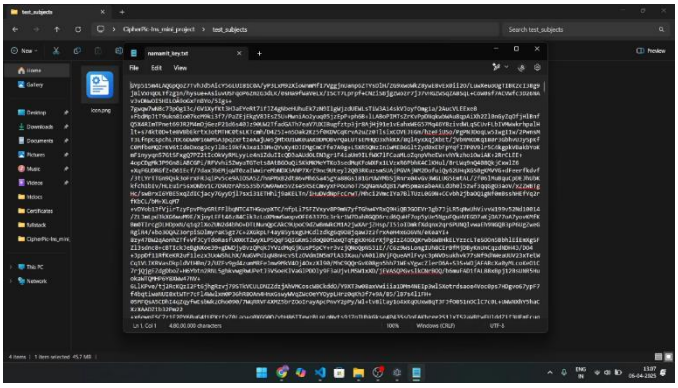

Fig 12: auto-generated Key.txt

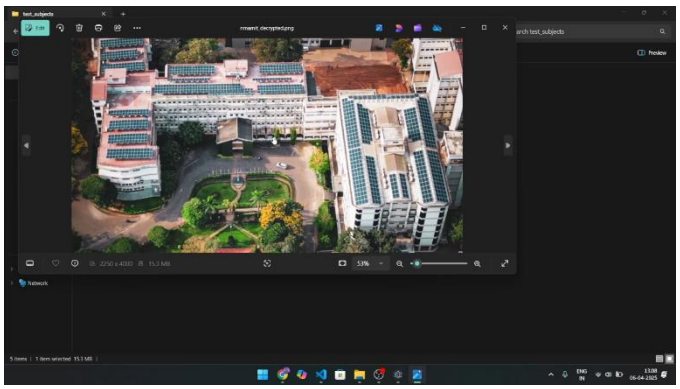

Fig 13: Image after Decryption

CONCLUSION

CipherPic is an efficient desktop application for solving secure image processing key issues. Through the use of the Electron framework and Jimp, a powerful image processing library, the application offers a simple interface to encrypt and decrypt image files with the help of encryption keys. Sensitive pictures are safely dealt with and kept away from unauthorized access with encryption.

- A successful project implementation for Secure Data Handling.
- Securely store data where encrypted images save with their keys only.
- The encrypted files can be shared without revealing the original files.
- We can create digital signatures where the key is used to validate the image and decrypt it.

CipherPic, a computer program designed for Operating Systems, functions as an image file encryption tool. It presents a practical solution to digital security issues.

FUTURE WORK

- **Secure Data Transmission:** Future versions may allow the secure transfer of files along with the exchanged encrypted data, for example, their images and corresponding keys, over encrypted channels like HTTPS or through peer-to-peer means.
- **Digital Signatures:** future versions could provide solutions for providing digital signatures; which will enable users to sign and authenticate encrypted images. We can achieve this using hash functions and public-private key pairs.

LINKS

- GitHub link of the project: https://github.com/ritheshnayak/CipherPic
- Demo Recording Link: https://youtu.be/BYDeOWHE7bs

References

[1] J. Ravi, R. Bhavana, P. R. Rohith, P. S. Kiran and P. S. Priyanka, "Image Encryption and Decryption Algorithm using," *International Journal of Advanced Research in Science, Communication and Technology (IJARSCT),* vol. 3, no. 1, p. 10, 2023.

- **https://www.electronjs.org/docs/latest**
- GeeksForGeeks