



International Journal for Innovative Engineering and Management Research

A Peer Reviewed Open Access International Journal

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IJIEMR Transactions, online available on 20th Jun 2022. Link

[:http://www.ijiemr.org/downloads.php?vol=Volume-11&issue=ISSUE-06](http://www.ijiemr.org/downloads.php?vol=Volume-11&issue=ISSUE-06)

DOI: 10.48047/IJIEMR/V11/I06/105

Title Pixel Based Encoding of Images

Volume 11, Issue 06, Pages: 1670-1675

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Pixel Based Encoding of Images

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Abstract—

In order to ensure the safety of communications being sent and received, all communication channels must be used. A broad range of data encryption methods are now available for a wide range of information transit platforms. Several scholars have suggested a kind of encryption based on permutations. Protecting digital images from hacker assaults is made simpler with the aid of an Image Encryption technique. As part of "pixels-based keys encryption," the image's rows and columns are encrypted using two secret keys. Using this algorithm, the encryption of images is fully lossless and very safe. The picture cannot be deciphered without these keys. A easy and secure way to encrypt data is advised.

Digital Image Scrambling, Encryption, and Processing

Introduction

A key data storage medium for civilian and military networks alike, digital photos and digital video-based digital images have become more common as networking technology has spread. A message that has been encoded using picture encryption is impenetrable to an eavesdropper or hacker. Digital image security has been a growing concern in recent years, and many methods for protecting these images have been developed. In order to make a picture more difficult to understand, an image encryption method is used. Decrypting an encrypted image yields the original image, but not with image encryption. Images may be encoded using an image encryption

technique, which aims to make them more difficult to decode. Unlike picture decryption, image encryption doesn't allow you to get back the original image from an encrypted one. As an example, scrambling methods such as block-based scrambling, pixel-based scrambling, and so on may be used.

Researchers that have used scrambling techniques to produce cypher images have suggested a number of different approaches for constructing cypher images. Image encryption and decryption was developed and implemented in order to safeguard picture-based data while it is sent and stored. Pixels in an image are strongly linked to

their neighbours, which explains why this happens. As a result of this strong correlation, it is possible to essentially predict the value of any given pixel's adjacent pixels. In order to reduce the correlation between adjacent pixels, a technique must be devised. As a result, we used the Scrambling technique to randomly rearrange the pixels in the picture. This kind of jumbled image is known as a "transformed picture." The XOR operator is then used to encrypt even more securely. A 32-bit key length is sufficient for our method.

System Analysis

Existing System

Grayscale pictures are being encrypted and decrypted, despite substantial study into image encryption and decryption, in order to get the best possible results. Despite the fact that this technology exists, encryption of several picture kinds, including colour images, has already taken done.

Proposed System

Pixel-based encryption is the key component of our strategy. An XOR operator is used to encrypt the image's rows and columns using two secret keys. It's common knowledge in the field of colour imaging that R, G, and B values for individual pixels may be used for this purpose. Records their values once they are divided into three matrices.

Two key arrays are the next phase. One-dimensional arrays are referred to as "Key Arrays." Array Kc, a one-dimensional (1-D) array, serves as the second key in the system. The values in these arrays fall within the range of 0 to

255, like pixels. The M x N Image determines the size of these arrays.

To create the jumbled picture, the R, G, and B arrays must first be scrambled. There is a way to do this by adding the rows of each matrix together and then rotating the accompanying Kr array row counterclockwise or anticlockwise by the corresponding Kc array value. Each column is checked to see whether its sum is even or odd before shifting by the constant Kc times.

Confusion has led to this outcome. The picture is first scrambled using Kr and Kc, and the resultant data is then subjected to an XOR operation. XOR the current row with the Kc value of the current iteration is used to replace rows with an odd number of items. To execute this XOR, you must rotate the Kc value for each element in an even row and perform XOR operations on them.

The next step is to replace any components in the R, G, and B arrays that are identical to Kr's value from the most recent iteration, and then repeat this procedure for each column. For odd-numbered columns, we perform XOR operations on each element and rotate the Kr values associated with it.

Finally, we have the Encrypted the Image.

Decryption begins by XORing R, G, and B arrays of the Encrypted Image with the Kr and Kc values from the encryption procedure. After that, we use the same rationale to reverse the rotation.

Technology Stack

Python

The high-level programming language Python is often used for a wide range of general-purpose

applications. Since Guido van Rossum and the Python community initially created it in 1991, the Python Software Foundation has been working on it. Because of the syntax of the code, programmers may convey their thoughts in a less number of lines.

Python Image Library (PIL)

An open-source library for the Python programming language that offers support for a wide range of image file types is the Python Imaging Library (PIL).

NUMPY

Programmers who work with the Python programming language may take use of NumPy's wide range of high-level mathematical operations on huge multi-dimensional arrays and matrixes.

PyQt5

PyQt may be used to create GUI widgets. The Qt graphical user interface (GUI) package, which is widely used across several platforms, provides a Python interface. Riverbank Computing Ltd. created PyQt. To get the most recent versions of PyQt, go to their website.

Proof Of The Concept System

Using the GUI application for encryption and decryption, these screenshots are shown.

Environmental Requirements

Software Requirements:

Operating System : Windows

Tool : Anaconda

Hardware requirements:

Processor : Pentium IV/III

Hard disk : minimum 80 GB

RAM : minimum 2 GB

Creation of Graphical User Interface

It is possible that this module will create GUI Python code automatically for use in controlling project activities (GUI).

In order to create the project's graphical user interfaces, we utilised the Qt Designer framework. The utility may be located in Anaconda's Library/Bin folder.

Using this graphical user interface, we may encode and decode picture formats.

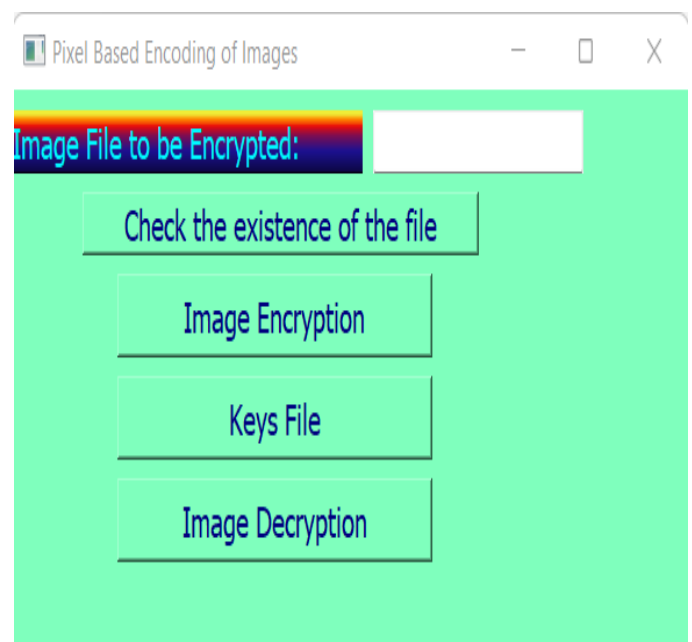


Fig. 1 User Interface

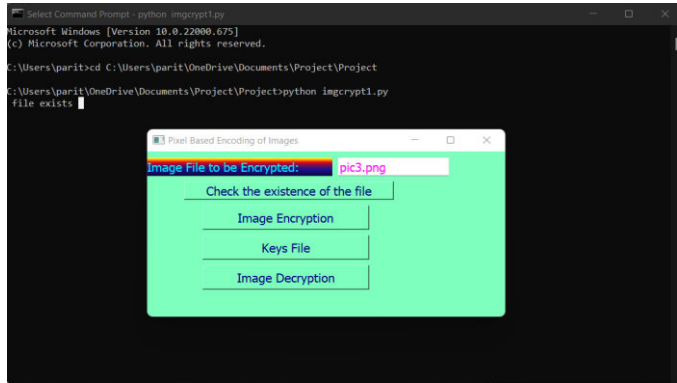


Fig. 2 File Existence Check

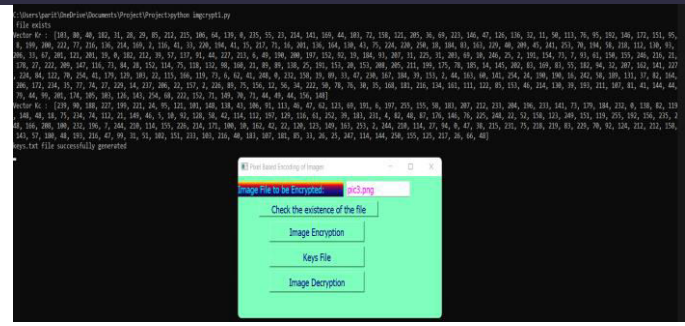


Fig. 5 Generation of Keys (Kr and Kc)



Fig. 6 Decrypted Image System Design

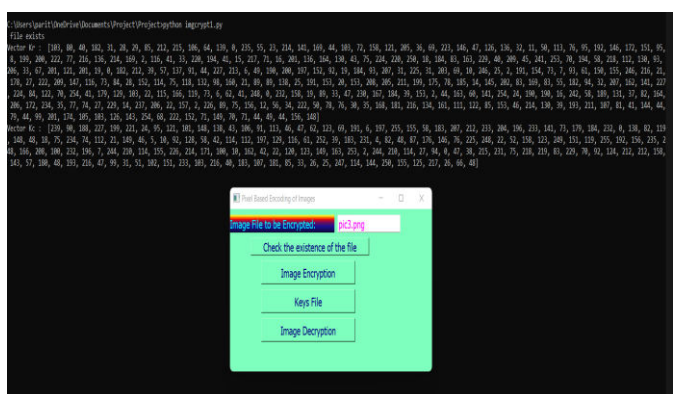


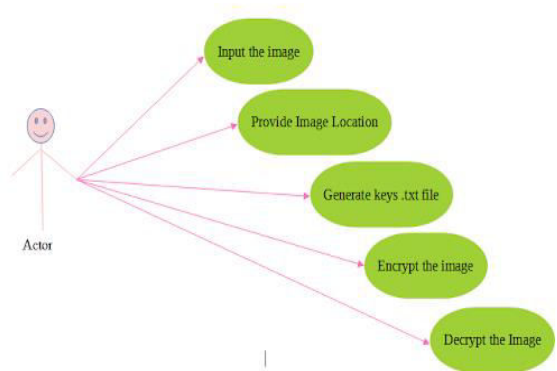
Fig. 3 Image Encryption



Fig.4 Encrypted Image

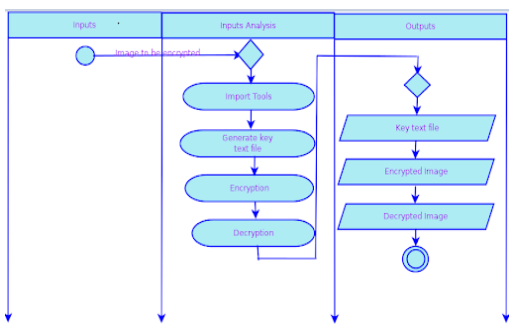
Use Case Diagram

An example of a use case diagram is one that shows all of the many ways the system may be put to use by different types of people.



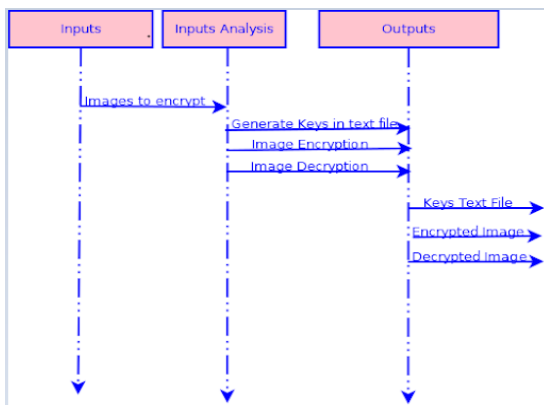
Activity Diagram

In a UML diagram known as an activity diagram, the system's dynamic features are shown. The term "activity diagram" refers to a kind of diagram that shows the progression of a series of activities.



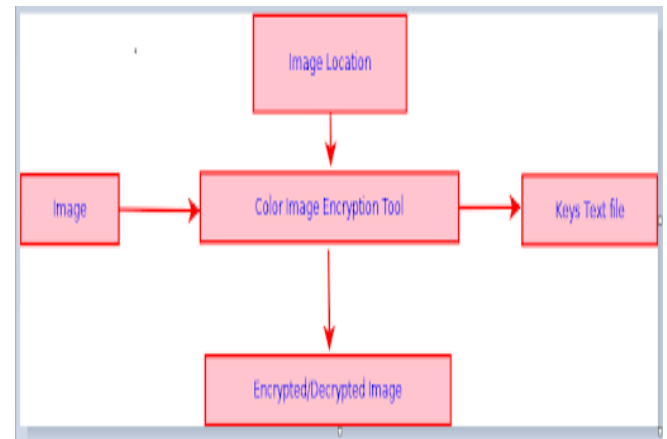
Sequence Diagram

Using a sequence diagram, you can see how and in what order certain elements work together. This is a message flow diagram in the most basic sense. As the name suggests, sequence diagrams demonstrate the relationships between several items in a sequential manner.



Data Flow Diagram

Data flows through a process or system may be shown graphically using a data flow diagram (usually an information system). The DFD contains the products and inputs of each component and the process as a whole. When it comes to decision-making and feedback loops, a data flow diagram doesn't have any.



Conclusion

In this study, XOR proved to be an excellent way for encrypting an image.' The unpredictability of the source image's pixels is enhanced by using an XOR method to encrypt. To put it another way, a more unpredictable image carries a higher level of security.

There are a number of advantages to using this kind of encryption, including the ability to ensure data integrity and minimise distortion, as well as high performance and speed. On a wide variety of colour photos, this study's proposed encryption approach worked well.

The encryption and decryption keys are identical in the original pictures. Encryption is done by



conducting an XOR operation with the original picture and the security key. A XOR operation is used to decode an encrypted image using the Security key. Security keys cannot be deciphered unless you know how they were encoded. As a result, we may infer that a photograph's security has been enhanced.

Future Work :

Anyone who wants to protect their picture galleries may use it online as a web application. We may also utilise video encryption and decryption to secure sensitive information. Secure Image Galleries may be created using this Image Encryption method.

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