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# A Novel Steganographic Approach for Embedding Secret Text in Multiple Images with Saw Tooth Pattern

B. Elangovan*, Tucha Kedir, Rabira GeletaIbsa, Yonas Biruku Addis

Bule Hora University, Bule Hora, West Guji, Ethiopia.

*Corresponding Author

***Abstract***— *Steganography is the science of sending the data secretly with the use of effective carrier. The ultimate focus of steganography is to hide the secret data from eavesdroppers. At the same time, this approach should keep the carrier medium's quality and it should be hard to hack the information by the eavesdroppers. This paper introduces a novel approach to embed the secret text in multiple image files as frame by frame. Initially the encrypted secret text will be split in to multiple frames as per the number of carrier images. Then each frame is rearranged as per Saw tooth pattern to increase the complexity for the eavesdroppers. The rearranged frames with the prefix of frame number will be embedded in carrier images one by one. As the reverse process, the receiver receives the set of Stego-images and the system will collect all the frames from the stego-images and arrange as per the frame order, then it decrypts using the secret key and produce the secret text.*

***Keywords***— ***Image Steganography, Digital data Security, LSB, Cryptography, Steganography.***

## I. INTRODUCTION

In the current digital world, the digital communication is an unavoidable methodology. When one technology grows, parallelly another approach also developed to break or to degrade those technologies by trap or break the security boundaries. A steganographic system is a science of providing the message transfer in the secret way. As this steganographic system is developed, the steg-analysis system also enriched day by day. So we are in the situation to fine-tune the steganographic algorithm to increase the complexity for the steg-analyzer.(Gandharba Swain et al.,2018;Elangovan et al.,2016).

This study introduce the modern approach in steganographic system, that make more anti steg- analysis dimension by hide the secret message in multiple carrier images as frame by frame and each frame is in encrypted form.(M Pavani et al., 2013)In the case of keeping secret data in a single cover media, it provides more possibilities for the steg-analyzer ,if he process for long duration.(SofyaneLadghamChikouche et al., 2017) But whenever there are more cover media for single message communication, it is very difficult to break the security.

In addition to that, the Saw-Tooth pattern provides more security for this message communication. In Saw-Tooth pattern, the value may change based on the size of two dimensional array. If the array size is changed during the extraction process, user can't get the actual data, instead of this, the system may produce the scrabbled data which will be in un readable format. So these multiple cover media, Saw-Tooth pattern, size of Saw-Tooth array and cryptography, all four make the system as more efficient and secured steganography.

## II. RELATED WORK

Steganography accurately means "covered writing".The need for the steganography ismentioned by (AnupriyaAryaet al.,2018),Information security is a major issue of concern while exchanging a data in an open network, as internet. The data security in the network is becoming more important as the volume of data being exchanged over the Internet increases day by day. The major ultimate techniques for providing the security for the data are cryptography and steganography.In the modern era cryptography and steganography are proposed for hidingsecret data from unwanted parties and hackers.

The need for modern updated approach for steganography is cleared mentioned by(Gandharba Swain et al., 2018).This work represents that, the simple substitution of secret data in LSB of carrier image is very guileless for the steg-analyzer. This will be the easy process to find the embedded secret message. So it suggeststo improve the complexity of steganography algorithm,which makes more complex or not possible for steg-analyzer.

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## III. PROPOSED WORK

In this proposed work, initially the secret text will be divided into n frames, where n is the number of carrier images. This proposed system supports more than one carrier media for the secret text, so it won't leads to the problem with the size of secret data.There are two major modules in this system, the first one is Hiding the Secret text and another one is retrieving the secret text.

### 3.1 Hiding the secret text in Carrier Images

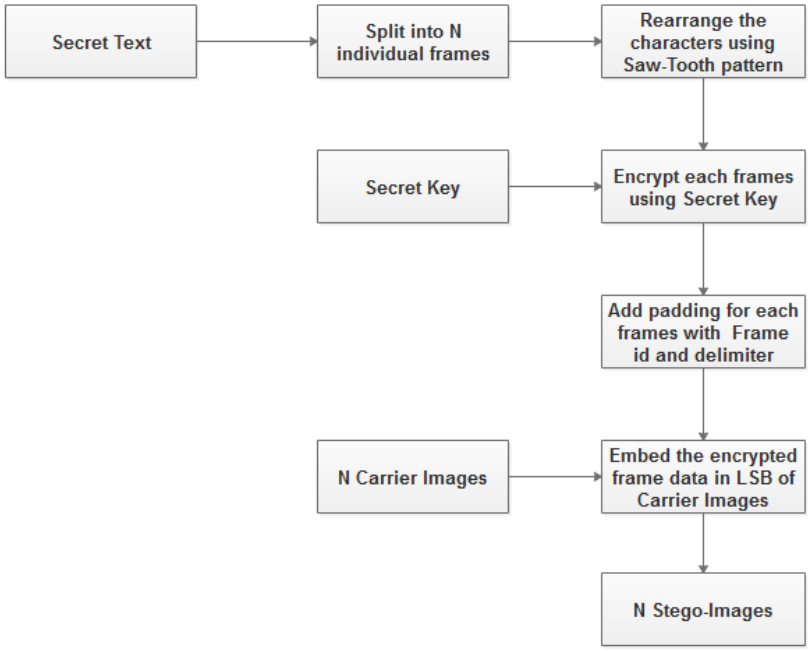


*Fig.1: Secret text Hiding in Multiple images*

Initially the secret text will be divided to N frames, where N represents the number of carrier images chosen for steganography. Then each N frames of secret text is rearranged with its characters by saw-tooth pattern.

Sample Text: THIS IS THE SECRET MESSAGE

The saw-tooth wave is a type of non-sinusoidal waveform. Since the shape of this pattern matches the teeth of a saw, it named as Saw-Tooth wave. This process can perform using the following formulae.

**Array value:n * (Index_Col -1) +Index_Row**

**n** is the size of the 2D array.

**Index_Row** – Row of the matrix.

**Index_Col** – Column of the matrix

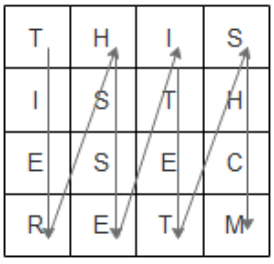


*Fig.2: Secret text framefilled in Saw-Tooth*

Where,

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **T** | **I** | **E** | **R** | **H** | **S** | **S** | **E** | **I** | **T** | **E** | **T** | **S** | **H** | **C** | **M** |

*Fig.3: A frame with rearranged characters*

Then each frame of rearranged secret data will be encrypted using the encryption key, the same key must be needed to decrypt the cipher text.

| | | |
|---|---|---|
| 01 | Encrypted Frame | *** |
| 02 | Encrypted Frame | *** |
| .. | Encrypted Frame | *** |
| N-1 | Encrypted Frame | *** |
| N | Encrypted Frame | *$* |

*Fig.4: List of encrypted frames with padding*

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The encrypted frames are undergoing the process of padding as in the Figure 4. In this status, front and rear padding for each frames will be added. At front padding, the frame number are added and the rear padding the delimiter are addedto specify the end of the frame. For the end frame, a special delimiter will be added to specify the final frame.

Using LSB substitution method, the encrypted data will be embedded in carrier images one by one. This process carried out by embed one frame in one Carrier Image. After embed all the frames, this process produces the set of N stego-images. In this stage, the stego-images act as the cover media for the secret text.

### 3.2 Retrieving the secret text

At the receiver end, there are N stego-images. This process will collect all the encrypted frames from the LSB with its frame number. For decryption process, we need to isolate the data part from each frame and then these frames are undergoing the decryption process with the secret key.

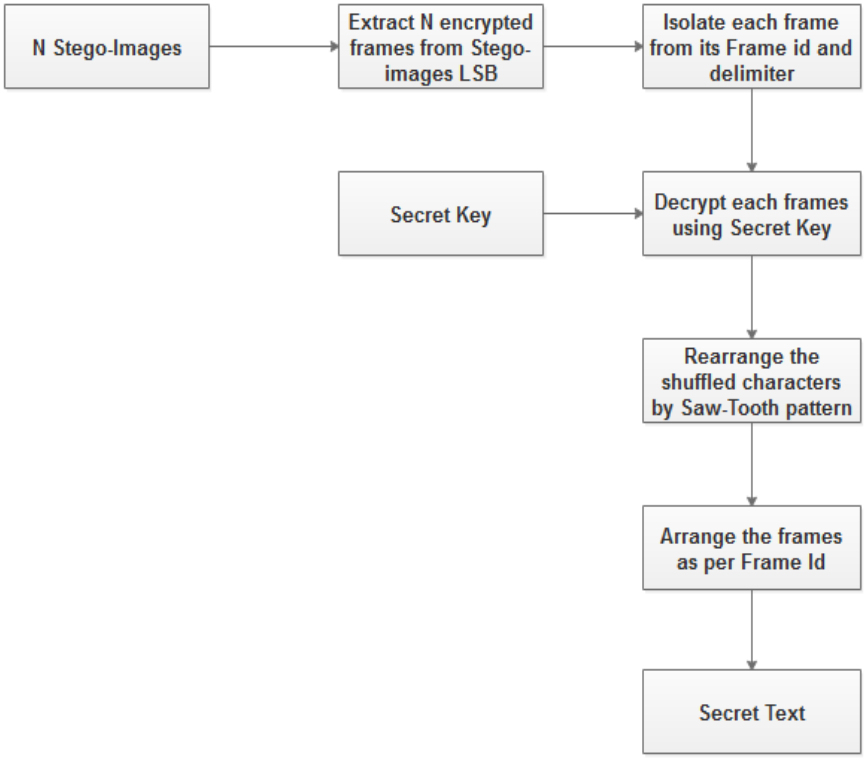


*Fig.5: Extraction process of secret text from stego-images.*

The decryption of each frame depends on the secret key, which key is used for encryption. If there is a mismatch in key, user can't fetch the exact data. After this successful decryption process, the decrypted frames are rearranged by its character using saw-tooth pattern.

Now using the frame number, the system will arrange all the frames in the sequence and produces the secret text in an efficient manner.

## IV. CONCLUSION

This paper introduces the novel approach for secured communication via steganography. The methodology introduced in this paper is to use multiple carrier images as cover media and saw-tooth pattern for shuffle thecharacters in each frame. It increases the complexity for steg-analyzer and unauthorized parties. In addition to that, the frames are encrypted and then embed in the carrier media. So it makes more secured communication.Another feature of this approach is that, it produces the stego-images with very less noise ratio, because it uses only one LSB in each pixel byte.Future work can be done by use the video and audio files as cover media which provides more space to hide the image and huge text.

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