A simple technique for steganography
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Abstract
A new technique for data hiding in digital image is proposed in this paper. Steganography is a well known technique for hiding data in an image, but generally the format of image plays a pivotal role in it, and the scheme is format dependent. In this paper we will discuss a new technique where irrespective of the format of image, we can easily hide a large amount of data without deteriorating the quality of the image. The data to be hidden is enciphered with the help of a secret key. This enciphered data is then embedded at the end of the image. The enciphered data bits are extracted and then deciphered with the help of same key used for encryption. Simulation results show that Image Quality Measures of this proposed scheme are better than the conventional LSB replacing technique. The proposed method is simple and is easy to implement.

1. INTRODUCTION
Pertaining to requirement of privacy and security, there has been a lot of progress in the field of text hiding and numerous new algorithms are being developed enhancing the science of hiding information in recent years.

Two data hiding approaches are generally used. First, without considering the image file format hide the information into the image file. In this case the inherent file properties are not utilized and the approach is more general in implementation. Second, designing the algorithm or the approach based on the inherent image file format. In this case least significant bit insertion, masking and filtering, algorithms and transformations etcetera are utilized. In the present work we use the first approach.

Steganography technique in technical field means having a piece of information and hiding it into another image. It is similar to cryptography. Though cryptography has its foundations in core mathematics and the encrypted message (through cryptography), in case intercepted, can not be understood unless the hiding mathematical tools are not applied in the correct way. While steganography, in an essence, "camouflages" a message to hide its existence and make it seem "invisible" thus concealing the fact that a message is being sent altogether. The advantage of this technique lies in the fact that though there is a message but no one will (possibly) suspect it. Examples of this technique are HP and Xeros printers, intelligence services and may be in love letters.

In the next section we present the proposed algorithm for data hiding. Section 3 involves the experimental results in comparison with other data hiding approaches. And finally concluding remarks are given in Section 4.

2. PROPOSED ALGORITHM
The proposed algorithm is based on appending the data at the end of the image file using file handling. The programming language used is C and is chosen due to ease of understanding and portability. Data hiding is used in conjunction with cryptography so that the information is doubly protected, first it is encrypted and then hidden so that an adversary has to first find the information and then has to decrypt it. Attempt has been made to develop a technique which is independent of any file format and can hide large amount of data with negligible distortion.
2.1 Hiding Principle

The data to be hidden does not take advantage of the fact that there are some areas present in the image which are not of too much importance, it just appends the data in encrypted form at the end of the image. It is a menu driven program which asks the user about the function to be performed. If user wants to hide the data he/she has to provide the image file into which data is hidden, data file whose data is to be hidden, the secret key and the marker. The image and the data file should be kept in the Bin of the compiler for the direct access. If they are not present in the bin a message invalid will be flashed on the screen. Two file pointers, one pointing to the image file and other pointing to the data file are initialized. The image file is read until the EOF (end of file) character is encountered, marker a special string is added at the end of the file which will mark the beginning of the hidden text.

The text to be hidden is first encrypted using a secret key that is shared between the sender and the receiver. The encryption used is monoalphabetic substitution i.e. if the character to be hidden is ‘a’ and key is 6 it will be stored as ‘g’. Since most of the data to hidden will be day to day English and if we append it directly at the end of the image we can view the data contents by opening it in a Notepad or WordPad. To overcome this problem value of key should be greater than equal to 26 so that the data to be hidden moves out of the range of the alphabets and could not be detected if opened in a Notepad or WordPad. ‘A’ is the first alphabet and needs key equal to 26 to move out of the alphabet range. This is the maximum value required by any alphabet and i.e. why key is taken to be greater or equal to 26.

2.2 Retrieving Principle

While retrieving the data receiver has to provide the image file, the new data file into which the data retrieved is written, the secret key and the marker. For the reliable recovery of the data from the image the correct knowledge of the key and marker is must.

Initial steps followed are same as those of the hiding process, two file pointers, one pointing to the image file and other pointing to the data file are initialized. The image file is read until the marker is encountered. This is done using nested if loop, which keeps on scanning the contents of the image file until the marker or EOF character is encountered. The presence of marker indicates that some data is present in the image. This indication is given by an indicator whose value is set 0 initially. On encountering the marker it’s status is modified to 1 and the loop is exited. If the marker is not found the value of the indicator remains 0. On coming out of the loop the value of the indicator is checked, if it is 1 we apply decryption algorithm on the data otherwise we exit the program and flash the message that there is no data present in the image. The data after the marker is decrypted using the priory knowledge of the key and is written into a new file that could either be a .C file, .txt file or any format. This new file created will be present in the BIN of the compiler and can be accessed from there.

2.3 Importance of the marker

The marker added to the image file before adding the data has a two way advantage first the data cannot be retrieved without it’s knowledge and second a different information can be hidden in the same image by just changing the marker which is not possible with other conventional techniques because in them the previous information has to be overwritten. For e.g. in LSB substitution technique the least significant bit is masked and the data to be hidden is placed in it’s position. Now if the same image is to be used for hiding the data the information hidden in those least significant bits will be overwritten by new information bits. Using this property we can hide more than one data file at a time in the image out of which only one is of importance. These different data files should have different markers and different keys. While extracting the data we can use the marker used for hiding the first data file but the key used will be same as used for encrypting the data to be hidden. The redundant data will make no sense on decryption and could be removed leaving behind the required data.

The secret key used for encryption can be obtained by studying the frequency of occurrence of the different characters in the encrypted data. However when different keys will be used it will be difficult to obtain the key used for encrypting the data to be hidden.

2.4 Implementation

The algorithm discussed above can be realized with the help of electronic circuitry (see Figure 1). The text to be hidden (plain text) is encrypted with the help of a secret key and converted to cipher text. Marker, a special string is added at the
end of the image in which data is hidden. Cipher text is added to the image after the marker and is then transmitted over a communication channel.

At the receiver side, we have a comparator with the image contents and marker as it's input. Initially the switch is closed, the output of the comparator remains low until both the inputs are not same. As soon as same inputs occur the output turns high and the switch is closed. Image contents move through the switch and decryption algorithm is applied to it which requires the knowledge of the secret key. The text thus obtained is the hidden message in the image. Since the marker is some characters long and according to the diagram only one character is being compared at a time we need a storage device for which we can use flip-flops; for example, if marker is 4 characters long we will use 4 flip-flops and so on. These flip-flops will be required for both the inputs of the comparator.

3. EXPERIMENTAL RESULTS

For demonstrating the effectiveness of this algorithm to embed high volume of data, we have used several images with different file formats. The result is analyzed with other hiding approaches and superior performance in our technique is quite obvious as it supports all image file formats and huge volume of data can be embedded into image without distorting it.

Hidden data is well protected when key is greater than 26. Moreover using this algorithm same image can be used to hide more than one data file at a time once which is not possible with many existing data hiding techniques. Although the file size increases after the appending of the data but it is not important if the amount of data that can be hidden is considered, moreover the adversary could not make it out unless he has the access to the original image without data.

The histogram plots of the images showing the gray levels and their frequency of occurrence are plotted and found to be identical for the image with data and that without data (See Figures 2 and 3), the histogram of error shows that there is no difference between the two.

4. CONCLUSION

In this method, a scheme of embedding large volume of data is presented. The scheme has following features: supports almost all image file formats, relatively large volume of data can be embedded in comparison to other data hiding techniques and image distortion is negligible, the data hiding ratio is improved considerably as the image pixel values are not changed. Use of a marker and encryption provides an extra layer of security. Future work is concerned with improving the security of the scheme by using advanced cryptographic techniques.
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