Hardware Implementation of LSB Based Data Hiding Algorithm in a Compressed Image

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***Abstract* —** *Nowadays, security of the secret data is a major problem. This paper proposes a new data hiding method based on LSB and DWT algorithms. In this proposed method the cover image is compressed using DWT algorithm. Then hide the data in to the compressed cover image using LSB algorithm. By this proposed technique text, image can be embedded at the same time without affecting the image quality.This system is implemented in Xilinx Spartan 3E kit using Xilinx platform studio with Microblaze soft core processor. The program is done with System C language. The PSNR, MSE value of the proposed technique is better than previous steganographic methods.*

Keywords ——*dwt compression algorithm, lsb algorithm, mse, psnr, steganography, System C language.*

I. INTRODUCTION

Today, steganography plays a major role in the case of secret data hiding. The secret information can be an image, text, audio or video. The name "steganography" comes from Greek language. Stegano means secret and Graphie means writing, so steganography means covered or secret writing.

Several steganographic methods are used for increasing security of information. Some of the techniques are LSB, DWT, and inverted LSB etc. Watermarking [4] is also a steganographic method. In which watermarking is used to verify the identity of ownership of that image. Watermarking is of two types visible and invisible watermarking.

Both steganography and cryptography [5] are used for ensuring the security of information. But there is a difference between them. Cryptography involves the encryption of data. But in steganography we don't encrypt the data. So the cryptographic techniques are more vulnerable to attack.

LSB algorithm and DWT algorithm are the two popular methods used in steganography. In the proposed method image and text can be embedded using lsb algorithm in a dwt compressed cover image.

II. LITERATURE REVIEW

In this section, we briefly review some of the works in the area of LSB embedding and DWT compression algorithms.

The scheme presented in [1] ensures the security against the steganalysis attack. In this algorithm MSB of secret image embedded in to LSB of cover image. In this n LSB of cover image ,from a byte is replaced by n MSB of secret image. The image quality of the stego-image can be greatly improved with low extra computational complexity.

Another coding technique presented in [3], data inserted in images by simple LSB substitution. The steganography uses of least significant bit (LSB) algorithms for hiding data into Jpeg (Joint Photographic Expert Group) images. The password is used for purpose of secret for encryption and decryption. The only authorized users can hide and disclose the message.

The compression technique presented in [2], first decomposes an image into coefficients and then the resulting coefficients are compared with a threshold. Coefficients below the threshold are set to zero. Finally, the coefficients above the threshold value are encoded with a loss less compression technique.

III. PROPOSED TECHNIQUE

Fig.1 Block diagram of the proposed technique**.**

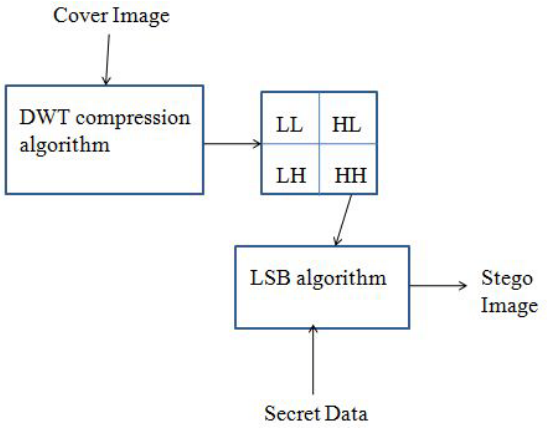
The proposed technique combines the DWT and LSB algorithm.

A. LSB Embedding Algorithm

Algorithm used to insert data into the cover image:

1: Read the cover image.

2: Read the secret information.



3: Based on the intensity value of the cover image, set n number of significant bits of the cover image to zero by using bit and operation.
4: Select first element (first character of a word or first pixel of an image) of the secret information.
5: The element is bit and with a=128.If the product is equal to a. Then add cover image pixel value after bit and operation with a value n using bit or operation.
6: If the product is not equal to a. Then divide a and a is bit and with the element.
7: Select next element of secret data.
8: Repeat step 5 until all elements of the secret data was embedded.
9: Display the stego image.

Algorithm used to extract secret data from stego image:
1: Read the stego image.
2: Based on the pixel value find the number of embedded bits.
3: Find the product of pixel value and number of embedded bits using bit and operation.
4: If the product is equal to number of embedded bits. Then find the secret data using bit or operation.
5: Display the secret data.

B. DWT Compression Algorithm

Algorithm used to compress the cover image:
1: Read the cover image.
2: Separate image horizontally. Addition of two nearby pixels provides lower coefficients. Repeat addition for entire rows. Difference of two nearby pixels gives the higher coefficients.
3: After finding the 1D transform. Separate the 1 D transform of the image vertically. Find detail and approximation coefficients using addition and subtraction of the nearby pixels of 1D transform.
4: Display the 2D transform of the cover image.

Block diagram of 1D and 2D transform is shown as below:

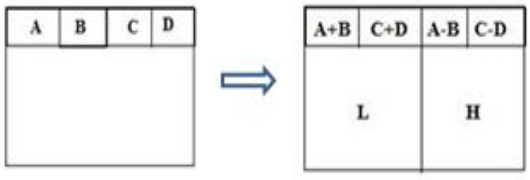


Fig.2 Block diagram of I D transform.

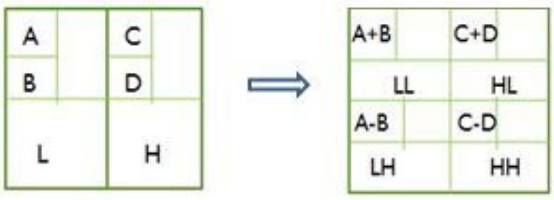


Fig.3 Block diagram of 2 D transform.

C. Proposed Algorithm

1: Read the cover image.
2: Compress the cover image using DWT algorithm.
3: Read the secret information (like text, image).
4: Embed the secret data in one of the compression coefficients of the cover image using LSB embedding algorithm.

IV. RESULTS

The Xilinx Spartan 3E kit is used to implement the proposed technique.Header files of the input images are created using Matlab. The Xilinx Platform Studio (XPS) software is used to simulate the entire system. The results of the hardware implementation are given below:

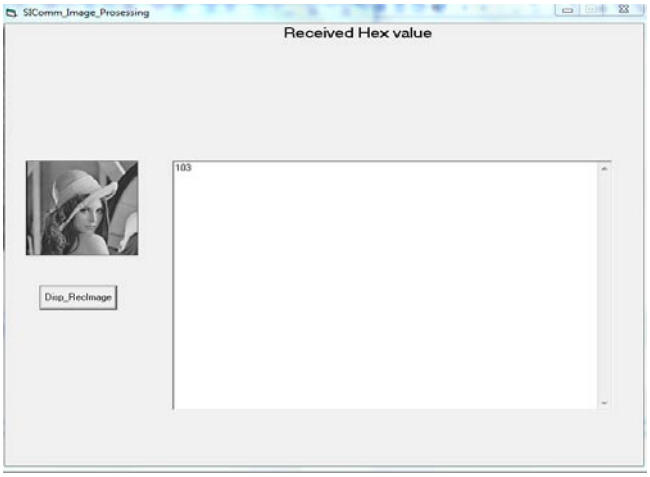
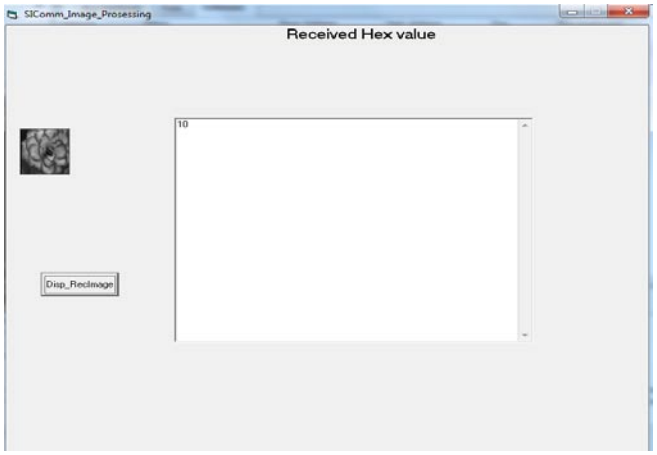


Fig.4. Compressed Cover Image
Fig.5 Secret Image



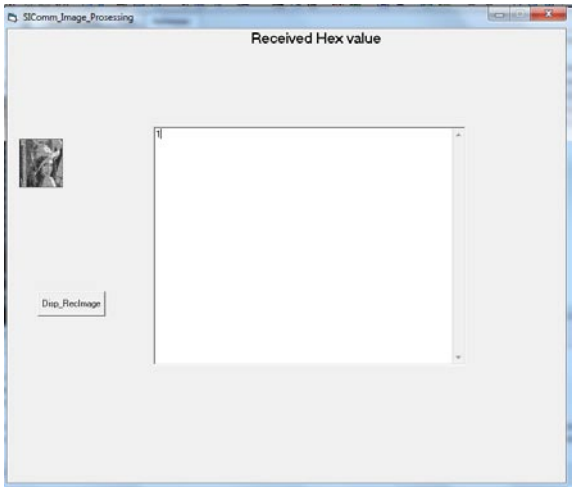


Fig.6 Embedded Image

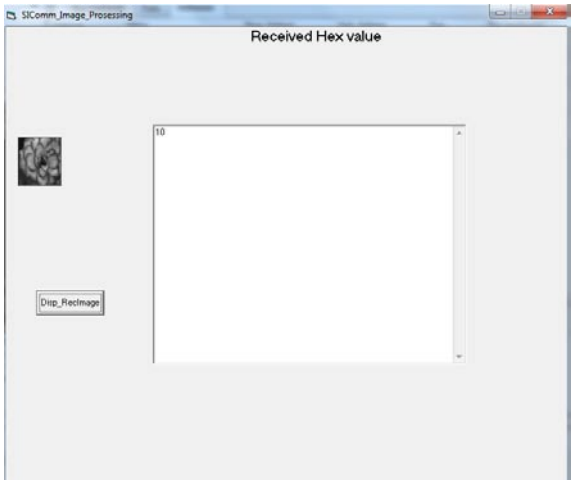


Fig.7 Extracted Image

The retrieved text displayed in the Hercules window is given below:

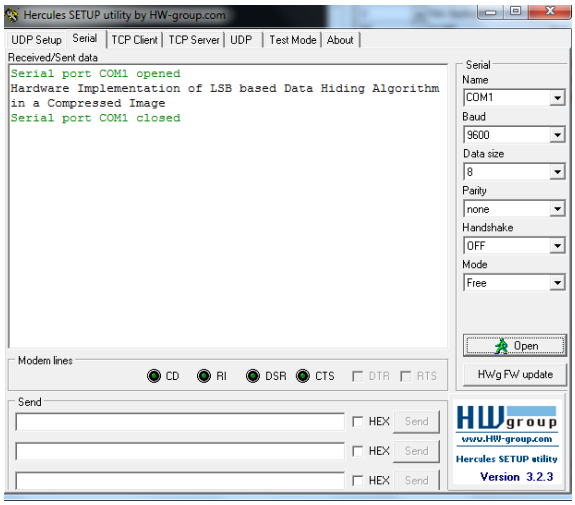


Fig.8 Extracted Text

The PSNR and MSE are compared with various steganography methods as shown in the following table 1.

TABLE I

PERFORMANCE STATISTICS

Method	PSNR	MSE
Proposed Technique	56.6675	0.5625
Simple Bit plane Slicing	40.0457	2.5839
Simple LSB Technique	38.8309	1.9404

The MSE and PSNR are calculated as follows:

$$MSE = \frac{\sum_{i=1}^{n}(pi-qi)^2}{n} \quad (1)$$

$$PSNR = 10\log\frac{(255)^2}{MSE} \quad (2)$$

Where, n: number of image pixel
pi: original image pixel
qi: retrieved image pixel

V. CONCLUSIONS

The proposed method results in better image quality. It is more secure and reliable than other steganographic methods. In this proposed algorithm the cover image is compressed using DWT algorithm. The secret data embedded in a compressed cover image using LSB algorithm. The PSNR and MSE values of proposed technique are better than other methods.

ACKNOWLEDGMENT

For the successful completion of this project, we thank Salmanul Faris, Engineer at KECL, Kuttippuram, India for providing the resources to carry out the project.

I thank my guide Rajkumar.P, Senior Assistant Professor in Department of Electronics and Communication Engineering, NCERC, pampady, India for providing valuable suggestions during the project.

I thank all my guides, family members and friends who helped me directly or indirectly during this work.

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