A Novel DWT & Correlation Based Audio Steganography

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***Abstract*:**This paper presents a method of hiding the text message intoaudio. Data hiding, a form of steganography, is one of the emerging techniques that embeds secret data into a digital media and thus ensures secured data transfer. In this paper, the steganographic method used, is based on audio steganography which isconcerned with embedding secret data in an audio file. The proposed method offers high quality ofsteganography process in terms of Peak Signal–to-Noise Ratio (PSNR).The technique isimplemented in matlab since it is a language for dataanalysis and numerical computation. This proposed scheme includes dynamic coding approach for hiding thesecret text. In this scheme no audible distortion after message insertion in audio signal.

Keywords*-Audio Steganography, PSNR, DWT, 1D filter bank*

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I. INTRODUCTION

Steganography is technique used to hide data in digital media. Audio Steganography is one of the popular data hiding techniques that embeds secret data in audio signals. The original audio data and the embedded audio signal are same in the sense of listen. By using audioSteganography we can hide text, image, and audio behind the original audio. The size of secret massage must be small than the data in which it is going to be hide. A secret massage is hidden within a cover signal using a 'secret key' .This 'secret key' should be kept secret otherwise third party person get recognize the secret data. The actual goal of this paper is to know ways of using audio as host media to hide text massage without affecting content and quality of audio file. Because degradation in the perceptual quality of the cover object may leads to a noticeable change in the cover object which may leads to the failure of objective of steganography.

II. PROPOSED STEGANOGRAPHY TRANSMITTER

Following figure 2 shows the block diagram of proposed secrete message embedding algorithm

Cover Audio file:
It is a file in which we are going to hide the secret data We have to select the cover file having ".wav" extension.

Apply DWT:
Cover audio is transformed using DWT, it will gives us two sub bands, CA (Approximation coefficients) and CD (Detailed Coefficients). These two bands are result of 1D filter bank as shown below.

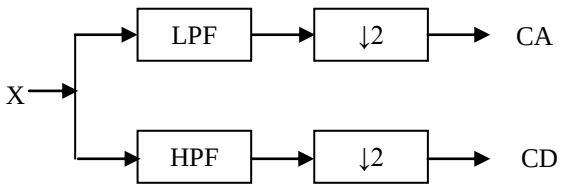

Figure 1. 1D DWT Analysis filter bank

Use of CD coefficient:
The sound file having two coefficients which are average coefficient (CA) and detailed coefficient (CD) . Out of which, the CD coefficient we are using for the purpose of hiding the data.

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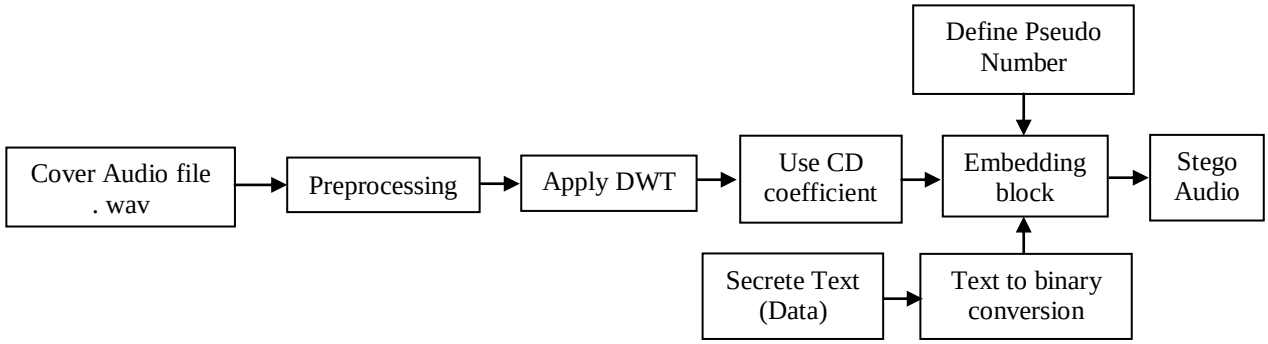

Figure 2. Propoesd Block Diagram of Steganography transmitter

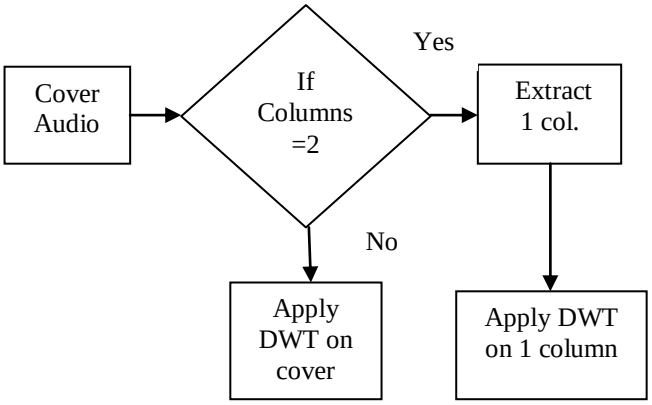

Figure 3. Flow chart of applying DWT

Defining pseudo number:
Additional components rather than usual steganographic objects used here is pseudo-random number. Pseudo-random sequences typically exhibit statistical randomness while being generated by an entirely deterministic causal process generator. If secret data having value 1 then pseudo number is added into corresponding wavelet coefficient and if secret data having value 0 then we keep wavelet coefficient as it is.

Converting secret data to binary:
Whatever the secret text data that we want to store , it should be converted to ASCII CODE. ASCII is an encoding system, known as an abbreviation for the American Standard Code for Information Interchange. The ASCII CODE is then converted to binary for the purpose of hiding.

Embedding block:
Now the actual work of hiding is started. Firstly, a secret message (or an embedded data) will be concealed in a cover-audio by applying an embedding algorithm to produce a stego-audio.The stego-audio will then be transmitted by a communication channel, e.g. Internet or mobile device to a receiver. For recovering the secret massage which sent by the sender, the receiver needs to use a recovering algorithm which is parameterized by a stego-key to extract the secret message. A stego-key is used to control the hiding process so as to restrict detection and/or recovery of the embedded data to parties who know it.

Stegoaudio:
After embedding the secret data with theCD coefficients we apply the IDWT to get original Audio. This stego audio contains our secret massage which is transmitted by transmitter .

III. PROPOSED STEGANOGRAPHY REICIEVER

Stego audio file:
This is the audio file transmitted by stenographic transmitter. Stego audio is containing the secret massage. To encode it, we have to extract it from the stego audio file.

Apply Inverse DWT:
The inverse wavelet transform transforms the signal from the time domain to the wavelet domain. This new domain contains morecomplicated basic functions called wavelets, mother wavelets or analyzing wavelets. The fundamental idea behind wavelets is to analyze the behavior of the signal with respect to scale. Any signal can then be represented by translated and scaled versions of the mother wavelet. Wavelet analysis is capable of enlightening aspects of data that other signal analysis techniques are unable to perform, aspects like trends, discontinuities. In higher derivatives, breakdown points and self-similarity.

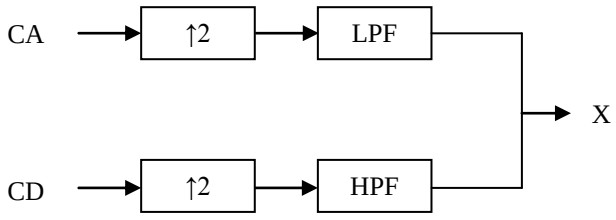

Figure 4. 1D IDWT Synthesis filter bank

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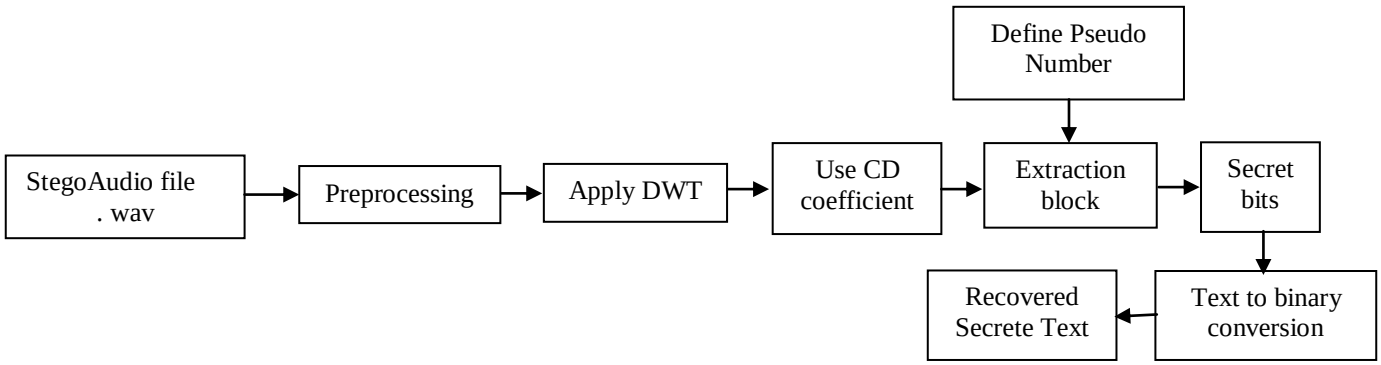


Figure 5. Propoesd Block Diagram of Steganography reciever

Correlation block:
In this step extraction of secret massage is carried out. Additionally correlationtheory is being used. Correlation is the degree to which two or more quantities are linearly associated. The correlation between two same size matrices can be calculated by:
Input:An1 × n carrier audio and a 1 × n stego-audio.
Output: a secret message

Extraction block:
Extraction block is used to recover the secret massage from the stego audio. By using the correlation theory it is easier to recover the secret massage .

Recovery ofdata:
After extraction of secret data bits they should have to convert to the original format. Hence to do this the binary to text conversion should be apply. First binary data is converted to ASCCII values and then that ASCCII values are converted to corresponding text.
Here we get our secrete data as it is at the receiver side.

IV. Result And Analysis

1. QUALITY PARAMETERS

A. SNR :

Signal-to-noise ratio (abbreviated SNR) is a measure used in science and engineering that compares the level of a desired signal to the level of background noise. It is defined as the ratio of signal power to the noise power, often expressed in decibels.

$$SNR = \frac{Psignal}{Nsignal}$$

Signal-to-noise ratio is defined as the power ratio between a signal (meaningful information) and the background noise (unwanted signal).where P is average power. Both signal and noise power must be measured at the same and equivalent points in a system, and within the same system bandwidth. If the variance of the signal and noise are known, and the signal is zero-mean.

B. PSNR :

Peak signal-to-noise ratio, often abbreviated PSNR, is an engineering term for the ratio between the maximum possible power of a signal and the power of corrupting noise that affects the fidelity of its representation. Because many signals have a very wide dynamic range, PSNR is usually expressed in terms of the logarithmic decibel scale.

$$PSNR = 10log_{10}\left(\frac{MAX_I^2}{MSE}\right)$$

PSNR is most commonly used to measure the quality of reconstruction of loss compression codec (e.g., for image compression). The signal in this case is the original data, and the noise is the error introduced by compression. When comparing compression codec's, PSNR is an approximation to human perception of reconstruction quality. Although a higher PSNR generally indicates that the reconstruction is of higher quality, in some cases it may not. One has to be extremely careful with the range of validity of this metric; it is only conclusively valid when it is used to compare results from the same codec (or codec type) and same content.

C. MSE :

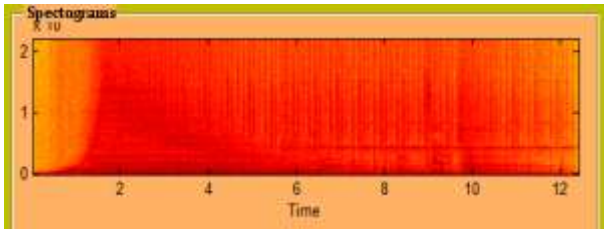
In statistics, the mean squared error (MSE) of an estimator measures the average of the squares of the "errors", that is, the difference between the estimator and what is estimated. MSE is a risk function, corresponding to the expected value of the squared error loss or quadratic loss. The difference occurs beuse of randomness or because the estimator doesn'taccount for information that could produce a more accurate estimate.

$$MSE = \frac{1}{mn}\sum_{i=0}^{m-1}\sum_{j=0}^{n-1}[I(i,j) - K(i,j)]^2$$

2.RESULTS

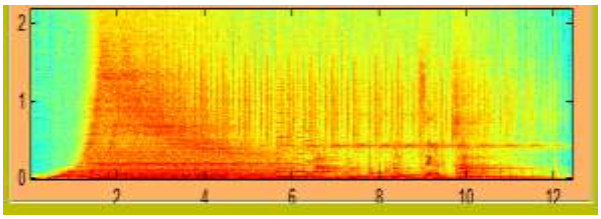
Spectrogram of Original signal:

The figure below shows spectrogram of original signal that is spectrogram without any secret data



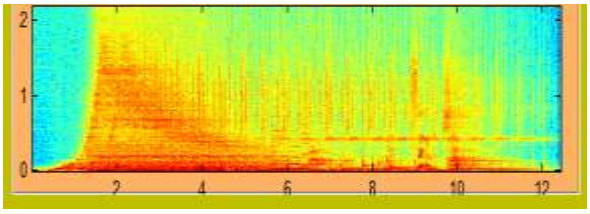
Secret data size = 1.15KB

In the original signal we have added the secret massage(data). This secret massage is having the size of 1.15 KB. Other parametres are as shown in table no. 1



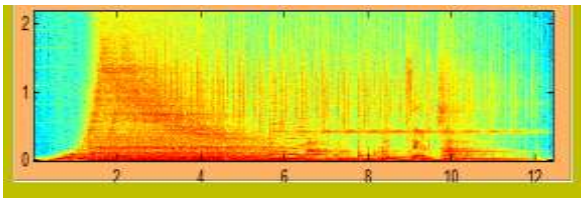
Secret data size = 1.65KB

The secret data of 1.65KB added to the original signal. Time required to embedd the audio is 14.3342 sec.



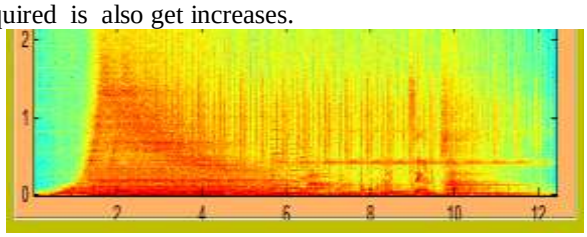
Secret data size = 2.33KB

The spectrogram given below is for the secret data size of 2.33KB. The time required to embed is 14.8221 sec.



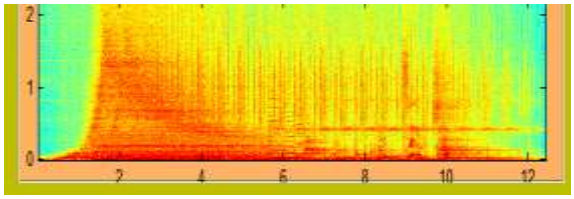
Secret data size = 2.90KB

Here the secret data size is increased and hence time required is also get increases.



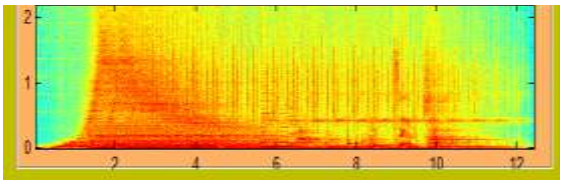
Secret data size = 4.45KB

The SNR value for data size 4.45KB is60.68. This SNR is less than previous one.



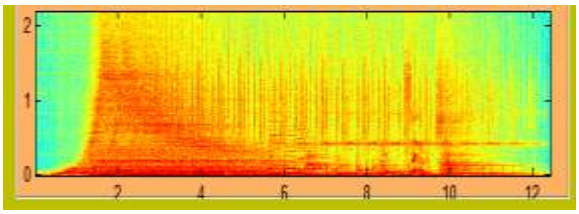
Secret data size = 5.41KB

The SNR value for data size 5.41KBis 60.68. This SNR Isagain less than previous one.Hence as we increasing the data size SNR is goingto decrease.The PSNR and MSE for this is 74.3647 and 3.64522e.0respectively



Secret data size = 7.28KB

The secret data of the size 7.28KB is adeed to original massage .The PSNR and MSE for this is 73.0811 and4.89876e.0 respectively



3. MATLAB IMPLEMENTATION:

We create matlab implementation of proposed scheme with GUI as shown below.

This GUI has two sides transmitter and receiver.

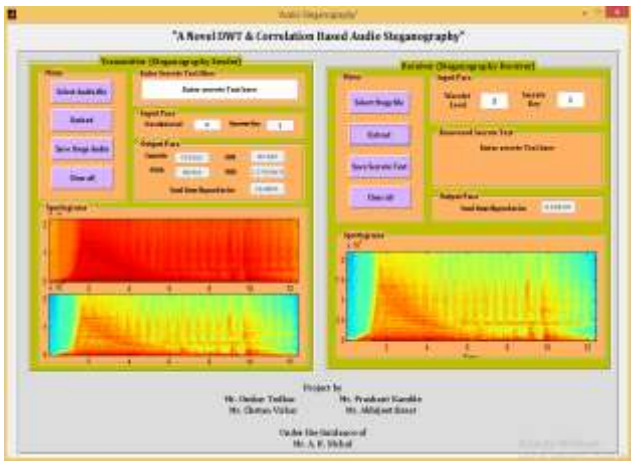


Figure 6. GUI Implementaion of Proposed Scheme

READINGS:

No.	Size(KB)	Capacity	SNR(db)	PSNR (db)	MSE	Time(sec.)
1.	1.15	274263	64.4453	80.8062	8.27124e.0	14.3342
2.	1.65	274263	63.2293	79.5903	1.09439e.0	14.8221
3.	2.33	274263	61.6088	77.9698	1.58935e.0	16.0443
4.	2.90	274263	60.6835	77.0445	1.96672e.0	16.8713
5.	4.54	274263	58.7764	75.1374	3.05108ee.0	20.9787
6.	5.41	274263	58.0037	74.3647	3.64522e.0	24.9547
7.	7.28	274263	56.7201	73.0811	4.89876e.0	32.0549

Table 1. Values of all Image quality Parameters for diff. text size

V. CONCLUSION

A method of embedding text-based data into a host audio file has been presented in this paper. A procedure has been developed in which the data field is edited to embed intended data into the audio file successfully. Many methods have been proposed for audio steganography, the robustness of a steganography depends on the technique used, audio and the signal processing operations. The different schemes have advantages and disadvantages. From the experimental results, it is found that the hidden secret data creates minimal changes in the cover audio and without altering its quality. Moreover, the secret data itself is successfully hidden and extracted very less amount of distortion.

VI. REFERENCES

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Prof. Arjun Nichal Received hisM.tech degree from walchand college of Enggsangli in 2012. Pursuing PHD from Shivaji University Kolhapur. Working as a assistant professor in AITRC vita. His area of interest is image processing, embedded system. Published one E-book and 11 international journal papers.

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