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DIGITAL AUDIO WATERMARKING FOR SECURITY ENHANCEMENT

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ABSTRACT

Digital watermarking is a technique of embedding and extract information into the multimedia. Many effective watermarking algorithms have been proposed and implemented for digital images and video, however few algorithms have been proposed for audio watermarking. This is due to the fact that, the human audio system is far more complex and sensitive than the human visual system. In this paper an imperceptible and embedding blocking code optimization truncation algorithm based on the discrete wavelet transform is proposed. Performance of the algorithm has been evaluated extensively,and simulation results are presented to demonstrate the imperceptibility and robustness of the proposed algorithm.

KEYWORDS: DCT,DWT,IWT,SVD,Encryption.

1. INTRODUCTION

Watermarking techniques have been in use since late centerages. Recent advances in Internet and digital multimedia technology have allowed transmission and distribution of digital multimedia(audio, image ,video) easily and efficiently to distant places[1]. However this convenience allows unauthorized copying and distribution of multimedia data[7]. This embedded data can later be detected or extracted from the audio signal for various applications. Audio signal can be assessed by various signal processing techniques[8]. The watermark must be statistically undetectable to thwart unauthorized removal by a pirate.

Watermarking embedding convert message into secret message. watermarking in encryption data can be used from audio[9] video and image. example the patient detail hide from image in audio watermarking, can be seen from only transmitter person to receiver person, then for unknown person it cannot be visible. In this proposed work both DWT and DCT combination is used for watermarking [2] and EBCOT (Embedded blocking code optimization truncation) is used for digital audio watermarking[10] for security enhancement.

TEXT-varying spaces after punctuation, spaces in between lines of text, spaces at the end of sentences etc.

AUDIO-Low bit coding, random.
IMAGES/VIDEO-Least-significant bit, random
Audio watermarking is a technology to hide information in an audio file without the information being audible to the listener and without affecting in any way the audio quality of the original file. Audio watermarks are special signals embedded into digital audio they can be extracted by detection mechanism and decoded they are used to track authenticate and prevent illegal distribution and manipulation of copy right digital audio. Audio watermarking schemes rely on imperfections of the human auditory system.

Temporal watermarking hides watermarks directly into digital audio signals in the time domain. The spectral audio watermarking applies certain frequency transform such as FFT[11], DCT and DWT etc to the data block of the audio signals and hides the watermark information into the transformed data block

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2. METHODOLOGY

2.1 Discertewavelet transform

Wavelet transform is a modern technique frequentely used in digital image processing, comparison, watermarking etc. The transform are based on small waves, called wavelet of varying frequency and limited duration. A wavelet series is representation of a square integrable function by a certain ortho-normal series generated by a wavelet[3]. The properties of wavelet could decompose original signal into wavelet transform coefficients which contains the position information. The original signal can be completely reconstructed by performing Inverse Wavelet Transformation on these coefficients. Watermark in the wavelet transform domain is generally a problem of embedding watermark in the bands of the cover image.

The basic idea of DWT is to divide frequency details, which is multi-resolution decomposition. The audio signal can be transformed into frequency domain ranging from low frequency to elevated frequency. The imageis compress during (DWT)when the medical images content and digital watermarking embedding in region of non interest (RONI) using lossles watermarking technique**[6]**.But, high frequency spectrum is fewer sensitive to human ears[16]. Thus the high frequency constituent is typically discarded in the compression procedure. Therefore in sequence to be concealed can be embedded into the low frequency constituent to alongside the compression attack.

2.2 Embedded block coding with optimized truncation algorithm

EBCOT block receives a set of quantization coefficients together within a code block. EBCOT encodes each bit-plane in three coding passes. The three coding passes in the order in which they are performed on each bit-plane are significant propagation pass, magnitude refinement pass, and cleanup pass. The code block is partitioned into horizontal stripes, each having a nominal height of four samples. Within a stripe, columns are scanned from left to right. within a column, samples are scanned from top to bottom.

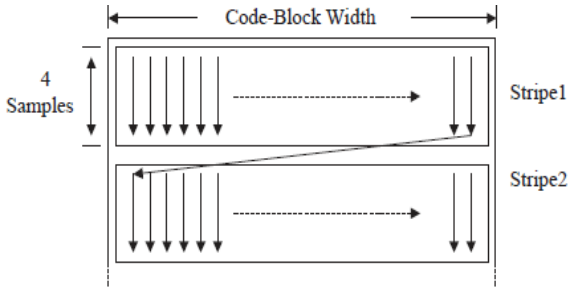

Fig.1 EBCOT Process

Each coefficient bit in the bit plane is coded in only one of the three coding passes and for each coefficient in a block is assigned a binary state variable called its significance state that is initialized to zero at the start of the encoding[4]. The significance state changes from zero to one when the first nonzero magnitude bit is found. The context vector for a given coefficient is the binary vector consisting of the significance states of its eight immediate neighbour coefficients. For each pass, contexts are created which are provided to the arithmetic coder.

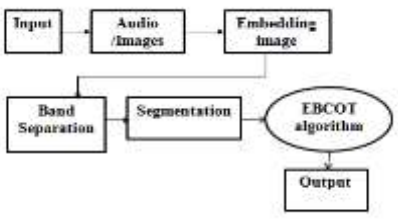

Fig.2.1 Transmitter

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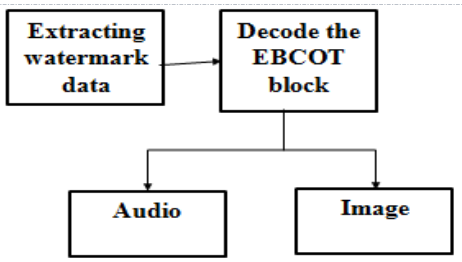

Fig.2.2 Receiver

First the 'Intialize Audio Device' step is processed and in the 'Water marking Embedded Algorithm' step, the watermarking sequence generated in the 'Encoding' step is embedded on the wavelet transformed coefficient bits. In the 'Inverse wavelet transform' step the wavelet inverse transformation is conducted to generate the watermark embedded audio signal. Audio signal can be recognized using perceptual features[12] and various modelling techniques[13]. A standard tool kit HTK is used to analyze and recognize the audio signal[14],[15].

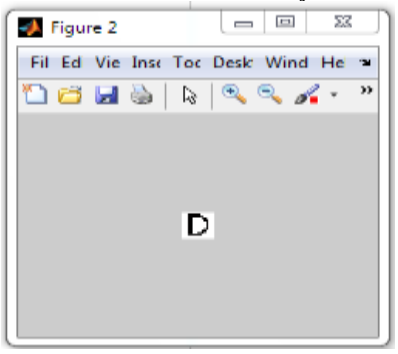

Fig.3. Input

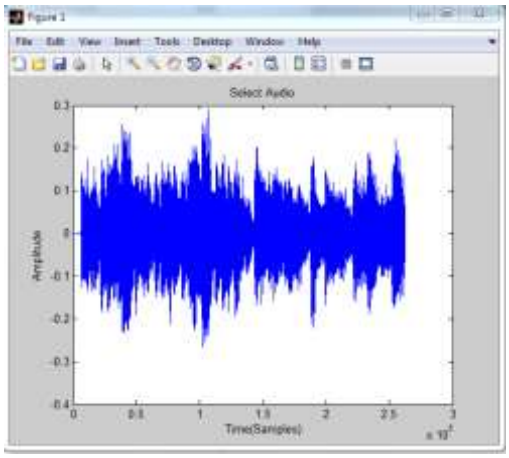

Fig.4 Audio selection process

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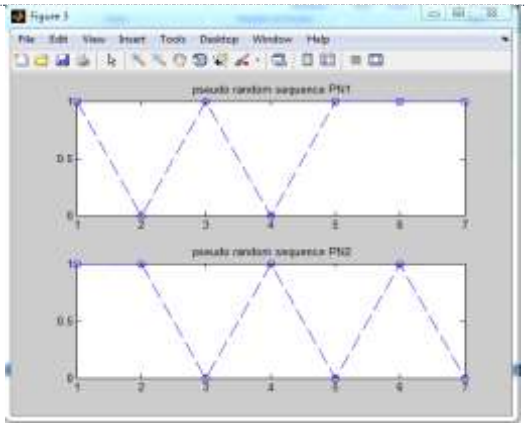

Fig.5.Generated Sequence

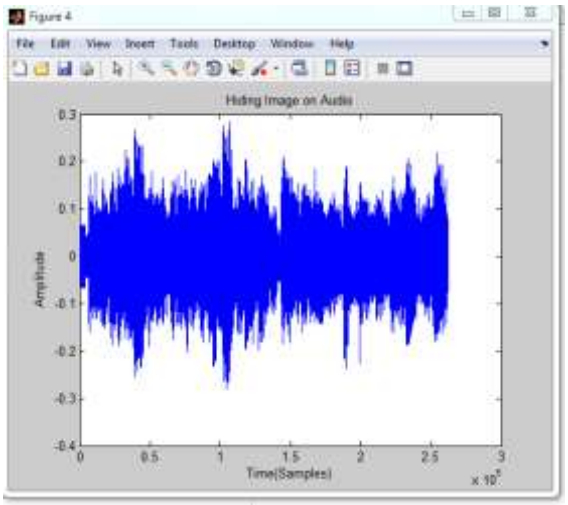

Fig.6. Watermarked Audio

The watermarking sequence is embedded onits coefficient bits and in these process the audio signal was transformed into the wavelet transform in wavelet based frequency band signal. The extracted watermarking sequences can be verified by watermark keys after performing decoding based the average intensity of the block[5] .

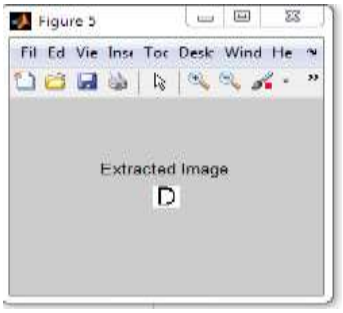

Fig.7. Extracted Image

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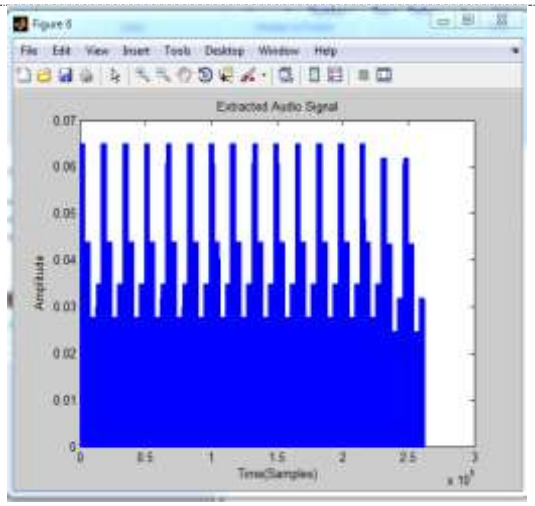

Fig.8. Extracted Audio Signal

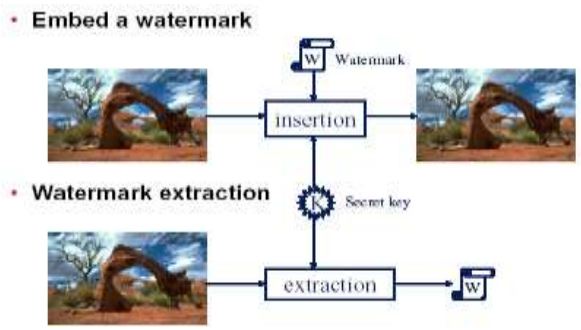

Fig.9. Watermarking embedding & extraction

3. RESULTS

Watermarking is done in the transmitter stage and extraction of audio information from the embedded image is done in receiver stage. In transmitter stage audio signal is converted into acceptable format in MATLAB. Second input image which is larger in size than that of embedding audio is chosen. Audio is embedded into the input image using DWT method and band separation is done. Now the segmented frames of audio signal is embedded into image using EBCOT algorithm. At the output of transmitter the audio signal is embedded into given input image. In receiver stage extraction of audio signal from the input image is done using EBCOT decoding algorithm.

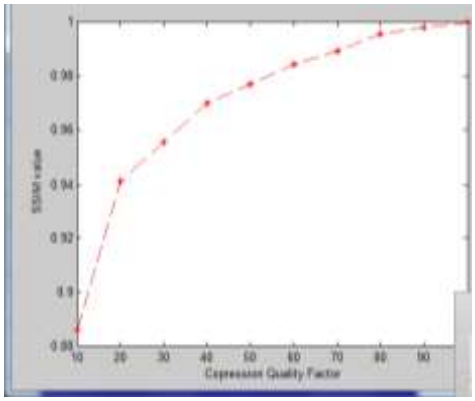

Fig.10 Quality factor verses SSIM values

In the Fig.10 graph shows x axis consist of quality factor and y axis shows the SSIM process. The graph drawn between lower to higher process.

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Audio watermarking against synchronization attack, causes the audio watermarking against synchronization attack ability is limited.

Using EBCOT method of decoding algorithm provides high signal to noise ratio, low Bit error rate in the sense the signal strength is more and it dominants the noise in the system.

4. CONCLUSION

Watermark can be embedded in an audio signal without being recognized by hearing and the perceptibility requirement is fulfilled. Extraction can be done without the presence of the original signal and the watermark itself, so can be classified as blind or public watermarking. In this proposed procedure DWT based EBCOT algorithm is proposed. The proposed technique generates watermarked audios of good quality and high tolerance to MP3 compression. As a whole, the security was improved by using the feature secret key to embed and extract the watermark information.

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