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Optimized Audio Watermarking Based On Discrete Transformation for Secure Transmission

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Abstract—*Many effective watermarking algorithms have been suggest and implemented for digital images and digital video. However, a few algorithms have been suggest for audio watermarking. This is due to the fact that, human auditory system (HAS) is far more complicated and sensitive than human vision system (HVS). In this research work, a new method of embedding image information into the audio signal and pertaining audio watermarking algorithm based on Discrete Cosine Transformation (DCT) and Discrete Wavelet Transformation(DWT) domain is proposed. The process of embedding a watermark image on an audio signal in such a way that there are no audible changes in the audio and it seems exactly like the original audio.*

Keywords—*Audio watermarking, Discrete Cosine Transformation, Arnold Transformation, Discrete Wavelet Transformation, SNR, MSE, NCC and BER.*

I. INTRODUCTION

Digital watermarking schemes currently are the most interesting and popular research area for legal protection of the multimedia data, where a lot of work has been done and is still being developed for finding more improved methods to increase the security, robustness and quality of watermarked data. Various techniques has been used to place watermarks to the audio signals which are generally based on two approaches: (a) non-blind (or informed) watermarking: This make requires the original signal information to recover watermark from the watermarked signal and (b) blind watermarking: This make does not require original signal information to recover the watermark from the watermarked signal. In recent years more research is focused towards developing blind watermarking techniques to avoid the use of original signal information to extract watermark information as the original information is always available to us.

II. SYSTEM MODULES

Encoding is the process of embedding a watermark image on an audio signal in such a way that there are no audible changes in the audio and it seems exactly like the original audio.

Encoding Algorithm is explained as:

Step 1: Select the original audio. Here, we have preferred *.wav or *.WAV format.

Step 2: Select the watermark image and convert it into a binary image and resize it to 32x32 matrices.

Step 3: A private key with Arnold transformation is applied on image S and Scrambled Secret Image is obtained.Arnold Period for a 32x32 image is 24.

Step 4: The watermark is converted into a vector.

Step 5: The audio is divided into the various segments of fixed length.

Step 6: Apply the H-level DWT. H is selected such that length of low frequency coefficients should be MN.

Step 7: Do the DCT on low frequency coefficients.

Step 8: Embed the Watermark bits as per the Quantization Function selected.

Step 9: Apply the Inverse DCT and Inverse DWT on the quantized low frequency coefficients.
Step 10: The divided segments of Audio are re-arranged into a single audio and saved it as a wAudio1, wAudio2 and wAudio3.

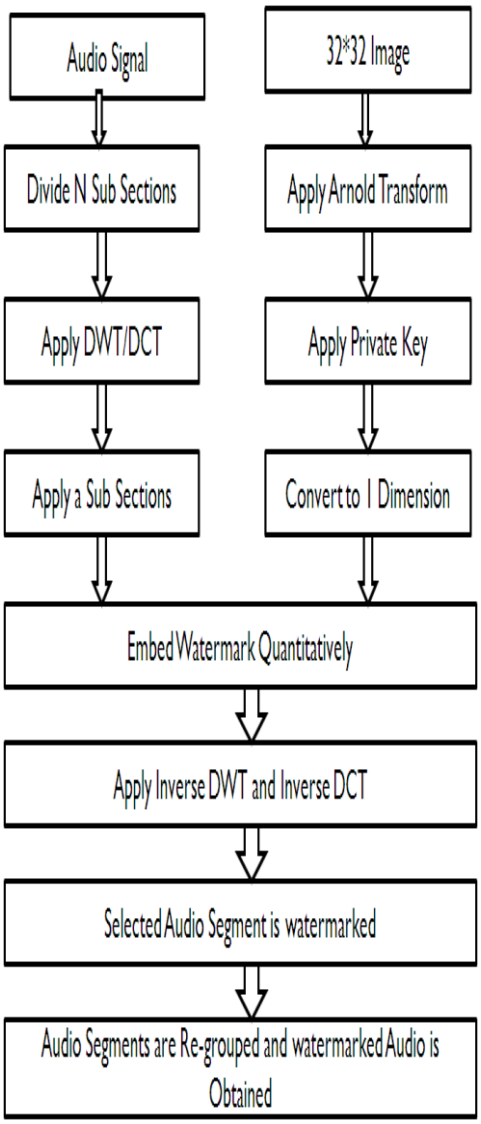

Fig.1.Watermark Encoding Process

Decoding is done at the receiver's end to extract the embedded watermark image.
Decoding Algorithm is explained as:

Step 1: Select the watermarked audio which was saved after the encoding process.
Step 2: Divide the audio into various segments as it was done during encoding.
Step 3: Apply DCT and DWT again on the selected segment.
Step 4: Now, as the quantization was used to embed the watermark on the audio, according to that quantization, apply the opposite and extract the watermark.
Step 5: Entered the private key or otherwise the watermark extracted will be a scrambled image.
Step 6: Once the watermark is extracted, apply various attacks like Compression, White Gaussian and filtering and check SNR, MSE, NCC and BER.

Step 7: Observe the calculated parameters and draw the conclusion.

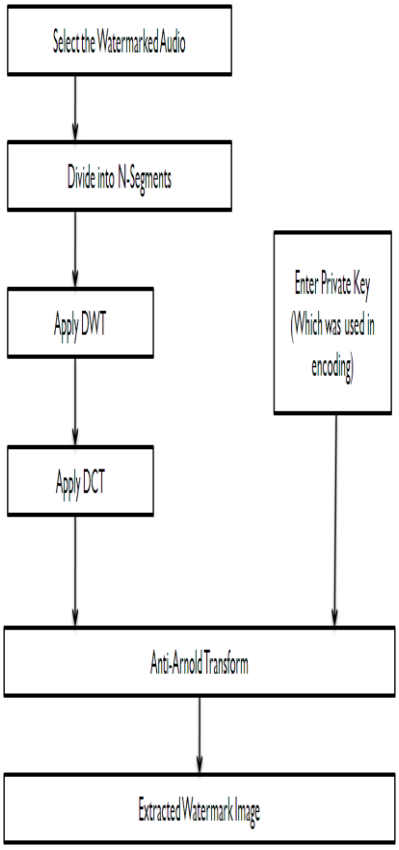

Fig. 2.Watermark Decoding Process

III. CONCLUSION

In this paper, we have presented a new watermarking system using Discrete Cosine Transform (DCT) for copyright protection of audio sound. Experimental results indicate that our proposed watermarking system has compromise audibility and robustness better. This method also shows strong robustness against several kinds of attacks such as noise addition, re-sampling, requantization,filtering etc. This results obtained verify the effectiveness of audio watermarking as a reliable solution to the copyright protection problem which is facing the music industry.

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