CONCEALING INFORMATION IN H.264/AVC COMPRESSED VIDEO USING DWT

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ABSTRACT

Information Concealing is the latest covert communication technique.In this technique the information that is to be conceal is encapsulated into the H.264/AVC video without affecting the normal features of the video using discrete wavelet transform.Thus a privacy protection mechanism in H.264/AVC video is proposed. The sensitive or private visual information in frames, which should not be viewable by the general public or regular users is concealed in a video.In order to allow the certified users to recover the concealed information in a video frames, the methodology of information concealing that is steganography is employed; After retrieving the data, the authorized users can descramble the protected areas in frames.

Keywords - Concealing, Dwt, H.264/AVC, Information, Motion Vector, Steganography

I. INTRODUCTION

The rapid growth and widespread use of electronic data processing and electronic business conducted through the internet,with diverse occurrences of international terrorism,implies the need for better approach of preserving the computers and the information transmitted.So during transmission,there is a need to protect the confidential information we send.But hackers can easily access the information illegally through the process of hacking,spoofing and phishing.So inorder to fool the hacker and to transfer the information securely some concealing mechanism must be implement.The explosion of forcible sharing/transmission mechanism of digital video contents has created an earnest need to explore the algorithms of concealing information into the digital videos[1].H.264/AVC is the recent standard for video compression with high compression efficiency and enhanced compression performance on video representation.H.264 video compression standard used for various purposes,including video telephony,storage and streaming applications.Furthermore,it is well-suited for network communication. H.264/AVC is hover to replace the existing video coding standards [2]. Concealing information into the digital video streams can be applied for many purposes, such as copyright protection, covert communication and error concealment.Existing information concealing method is based on Discrete Cosine Transform (DCT) which provides high embedding capacity and distortionless transfer of data [3]. It also cannot reconstruct the frames because of undesirable blocking artifacts.Further, correlation from the pixels of neighbouring blocks is neglected.In general,human eyes are more sensitive to chrominance than luminance components.Chrominance components conveys colour information of an image and luminance conveys black and white information.So binary images are more suitable for concealing information.But DCT does not perform efficiently on binary images.To overcome these problems a new method of information concealing using Discrete Wavelet Transform is proposed.Normally if some information is embedded into a video means the concealed information degrades the quality of the video.since DWT has high compression efficiency, so it improves the quality of the video during compression. So the resulting video which has embedded with secret information appears as the original video for the general users.

II. PROPOSED SYSTEM

In the proposed method,Discrete Wavelet Transform(DWT) is used for compression.It eliminates the limitations faced by Discrete Cosine Transform[4].The main use of discrete wavelet transform is, it performs well on binary images and also eliminates the blocking artifacts.It has high compression efficiency.First the input video is converted into frames.After converting them into frames,it is subjected to macro-block classification.Each frame is splitted into 8x8 luminance block called macro-block classification.Again each frame is subjected to motion estimation.A video has sequence of still images.Two successive frames in a video have minor differences.Motion estimation is the process which tracks difference between the frames inorder to reduce the temporal redundancy.Motion compensation describes an image interms of the transformation of a reference image to the present image. Motion compensation helps in identifying the place for conceal the information.The information which should be send secretly is embedded in video sequence and is stored in the motion vector.Normally uncompressed video could not be transfer easily and also it is expensive.So Discrete Wavelet Transform is used for compression.DWT has gained wide spread use in signal processing and image compression.After compression each frames are again combined into a video.The resuting video contain the concealed information which can be retrieved by the authorised user.

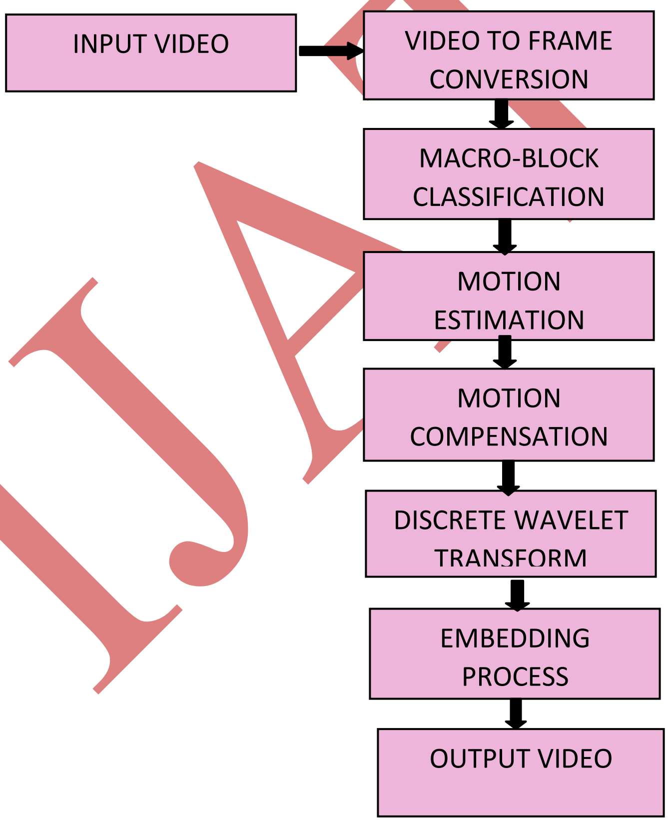

Fig 1.Block Diagram

2.1 Video to Frame Conversion

The video in AVI(Audio Video Interleave) format is taken as an input to conceal the information.This file format store both audio and video in standard package to allow its simultaneous play.The main reason for choosing this format is,it can be adaptable to any compression scheme.

2.2 Macro-Block Classification

Macroblock is a processing unit in image and video compression formats depend on linear block transforms, such as DWT.A macroblock typically consists of 8x8 luminance blocks and is again subdivided into transform blocks, and may be further subdivided into prediction blocks.H.264/AVC format is based on macroblocks and other formats which supports macroblock are JPEG, H.261, H.262 and H.263.In H.264/AVC, a macroblock can be split into multiple dissimilar sized prediction blocks called partitions. A macroblock in H.264/AVC, a separate motion vector is mentioned for each partition. Motion vectors are used for storing the amount of motion.

2.3 Motion Estimation

The H.264/AVC video that can be converted into frames.After converting them into frames is splitted into macroblock.Motion estimation is the process which compute the mere changes between the successive frames.The changes between the frames is estimated using the Block Matching Algorithm.This motion estimation can be done in two ways.(i)Global Motion Estimation and (ii) a specific parts of an image can also be estimated.

2.3.1 Block Matching Algorithm

A Block Matching Algorithm (BMA) is an algorithm which identifies the matching blocks in a sequence of video frames.The main objective of this algorithm is to estimate the motion of the frames.BMA identifies the temporal redundancy in a video sequence which can be used to increase the effectiveness of interframe video compression. The purpose of a block matching algorithm is to find a matching block from a frame i in some other frame j,which may appear before or after i. Block matching algorithms make use of an computation metric to determine whether a given block in frame j matches the search block in frame i[5]

The Mean squared error of an estimator is the cost function which computes the average of the squares of the errors.This MSE value estimates the corresponding difference between the frames. The cost function is Mean Squared Error (MSE) given by the equation

$$MSE = \frac{1}{S^2}\sum_{i=0}^{S-1}\sum_{j=0}^{S-1}\left(P_{ij} - Q_{ij}\right)^2 \text{ ---------(1)}$$

Where S is the side of the macroblock,Pij and Qij are the pixels being compared in present macroblock and reference macroblock,respectively.

Peak-Signal-To-Noise-Ratio(PSNR) represents the motion compensated frame build using motion vectors and macroblocks from the reference frame.

$$PSNR = 10Log_{10}\left[\frac{(Peak\ to\ peak\ value\ of\ original\ data)^2}{MSE}\right] \text{ --------(2)}$$

2.4 Motion Compensation

Motion estimation depreciate the energy in the motion-compensated residual frame and can greatly upgrade compression efficiency. The present frame is motion compensated by subtracting the model from the frame to produce a motion-compensated residual frame[6].Motion compensation is a technique which is used to generate a frame from the estimated difference which is stored in the motion vector.Block motion compensation is used which subdivide the frames into pixel blocks.Thus Motion compensation conveys the information to generate the successive frame from the reference frame and helps in identifying the place to conceal the information.

2.5 Steganography

Steganography is an approach to conceal a message,file or video with another video or file[7].The data hiding scheme used to conceal information is Histogram manipulation.In this encoding technique, the information which is to be conceal is embedded along with the H.264/AVC video.Normally the forepart of a video does not change position only the background of the video sequence moves slightly.So the venue which are unaffected by the object in forepart of the video is the best place to conceal the information[8].

2.6 Discrete Wavelet Transform

In Discrete Wavelet Transform, each wavelets are discretely sampled at regular intervals.It measure both frequency and position information. DWT can give greater compression ratio with better measurable deterioration of video quality.A wavelet function has two most important properties,

$$\int_{-\infty}^{0} \psi(t)dt = 0;$$

That is,the function is oscillatory

$$\int_{-\infty}^{0} |\psi(t)|^2 \, dt \leq \infty$$

That is, the energy is confined to finite duration.

2.7 Embedding Process

After compression all the frames are again combined into a video.The video with concealed information appears as the original video with slight distortion.Finally the concealed information along with the video is transferred to the authorized user.

III. EXPERIMENTAL RESULTS AND ANALYSIS

In this research,concealing information in H.264/AVC using Discrete Wavelet Transform(DWT) is done using MATLAB.First the input videos are converted into frames.Then each frame is splitted into 8x8 luminance blocks.The main objective of using luminance block is humans are sensitive to chrominance than luminance components.After macroblock classification,Motion Estimation process is carried out for each frame by using the block matching algorithm.Two parameters are measured for estimating the motion (i)Mean Squared Error and (ii)PSNR.These two values estimates the amount of motion between the successive frames and the results are stored in the motion vectors.Motion Compensation is the process to convert the present frame to the next frame using the MSE value.The experimental result shows that MSE value without Motion Compensation is 78.247 and MSE value with Motion Compensation is 0.00.PSNR value is used to estimate the ratio of high power signal to noise.Thus helps to identifies motion in a video sequence.Now the secret information that has to be conceal is embedded in to a video using encoding process.This process takes some seconds to embed the information into the video.Discrete Wavelet Transform is used for compression of frames and it achieves greater compression than DCT.Finally all frames are again combined into a video.The resulting video size and quality is kept under control.

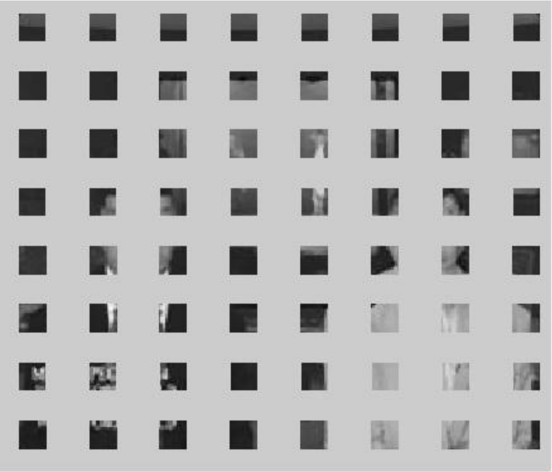

Fig 2 8x8 Luminance Macroblock

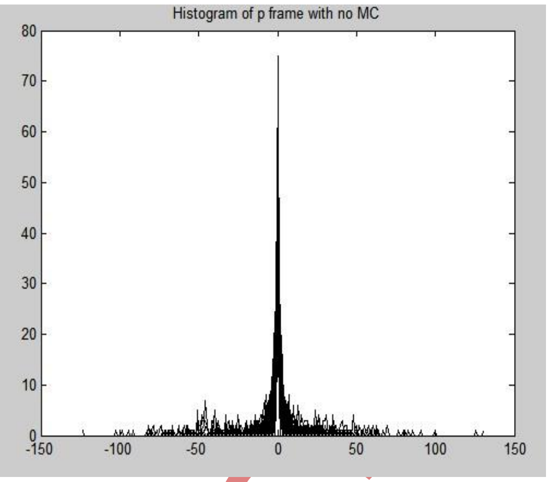

Fig 3 Histogram of P Frame Without Mc

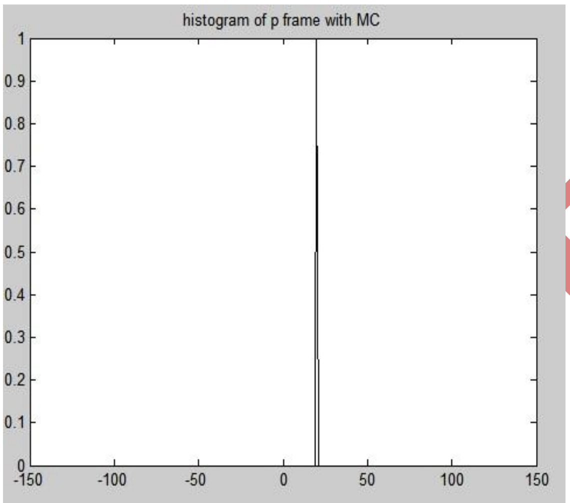

Fig 4.Histogram of P Frame with MC

Fig 5.Superimposed Motion Vectors

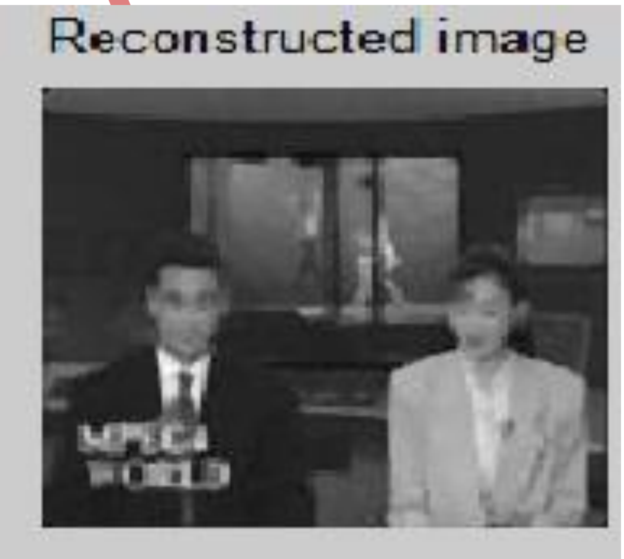

Fig 6.Reconstructed Image

Hiding Component	Hiding scheme	Related process	Payload	Size overhead	Impact on video quality	Computational complexity
Luma DWT coefficients	Histogram manupulation	Transform	High	Low	Moderate	Low
Chroma & luma DCT coefficients	Spread spectrum	Transform	Moderate	Low	Low	High
Block size selection	Mapping Rule	Prediction	Low	Moderate	Low	High

Table 1.Comparison of Venues In Information Hiding In H.264/AVC

IV. CONCLUSION

Thus the information concealing in H.264/AVC video is achieved successfully.Experimental results shows that the concealing of information can be achieved effectively and the size of the resulting video is kept under better control.Also proposed method has less computational complexity and low size overhead.The future scope of this research is to improve the quality of the video by using advanced Discrete Wavelet Transform.

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