EFFECTIVE EMBEDDING APPROACH FOR VIDEO STEGANOGRAPHY FOR SECRET DATA

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ABSTRACT

Recent advances in information technology have made quick delivery and sharing of multimedia information possible. But these advances in technology are leading breaches to information security and personal information. Now days, it is very risky to handle the data in internet against intruders. Data is generally in the form of text, audio, video and image. With the development of the technology, people have tend to figure out methods which are not only capable in hiding a message, but also capable of hiding the existence of a message. Steganography was introduced as a result of such research work. Steganography is the process of hiding secret information inside a data source which is referred as cover medium. Steganography has applications in different fields such as defence, medical, online transactions etc. It is mainly used in situations where the confidentiality of information is of prime importance in communication. Based on type of cover medium there is different type of steganography i.e. audio, video, text, image etc. Video Steganography is the process in which message is embedded inside the video type of cover medium in such manner that is existence. In this paper we analyze different video steganography techniques and their comparative study. To improve embedding process in terms of robustness and visual quality and hidden capacity advance LSB (Least Significant Bit) method and SVD(Singular Value Decomposition) is used in proposed model.

Keywords: *Video Steganography, Least Significant Bit (LSB), Robustness, Visual quality*

I.INTRODUCTION

In our day to day life demand of internet applications are more vurnable to various kinds of security attacks. For protecting the system mainly two fields are widely used that is steganography and cryptography. That approaches are maintained data confidentiality and data integrityduring data transmission. Steganography is a process that involves hiding important information (message) inside other carrier (cover) data to protect the message from unauthorized users[1]. Steganography is defined as the art and science of secret communications, primarily concealing the existence of the communication.[2].Even without them having any suspicion of the data's existence. Human Visual System (HVS) can't recognize a slight change that happens in the media cover such as audio, image and video [3].Cryptography is a process that involves encryption of message form protecting message unauthorized users.

Video Steganography the message is embedded inside the video for protecting message from unauthorized users. Any successful steganography mainly considered two important factors that is embedding payload and embedding efficiency. The embedding payload defined as amount of secret information which is embedding

inside the cover medium. This should be high[1].Embedding efficiency includes the stego video security, visual quality, robustness against attackers[2].Increasing efficiency will cause the capacity of embedding to have a low payload. Changing the balance between these two factors mainly depends on the users and the type of steganography scheme [3]. In steganography at sender side embedding process is done in which the message is embedded using key into original data is known as stego medium. On the other hand receiver side extracting process is done in which message is extracted using symmetric or same key which is used in sender side from stego medium as seen in fig 1. The symmetric key should be predefined between sender and receiver. Generally the video steganography is used for confidential applications like as military, defence, video watermarking, tamper detection etc. In our proposed model we use the advance LSB method for improving embedding process for video steganography in terms of robustness and visual quality.

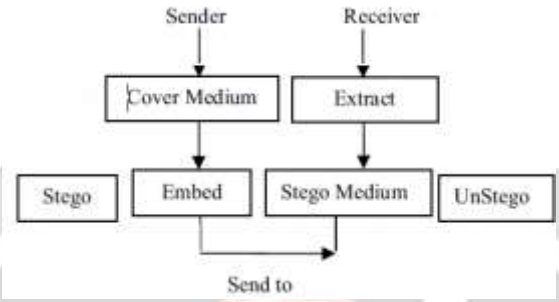

Fig -1: Steganography System [17]

In this paper, Section 2 describes parameters that need to be satisfied by video steganography technique and various techniques used for video steganography. Section 3 describes related work and system comparative study of techniques which have been used to hide secret data in video file.. Section 4 describes methods' introduction that have been used in proposed system Section 5 describes proposed work Section 6 describes result analysis and Conclusion is presented in Section 7.

II.BACKGROUND THEORY

For any successful video steganography system following measures should be considered:

A. Imperceptibility

Imperceptibility or undetectability refers to the visibility of modification inside the cover media. High Imperceptibility means increasing the invisibility of slight modifications in cover object. Modern day steganalysis approaches are highly intelligent to detect slight modifications. High Imperceptibility has motivated researches to design steganalysis resistant video steganography methods [6] [7].

B. Payload

Payload or capacity refers to the amount of secret message that can be concealed inside cover media [8]. Video are gaining popularity as highly used cover media object due to their high embedding capacity and embedding efficiency.

C. Robustness

The attacks or methods applied on stego object to extract hidden or secret information are known as statistical attack [9].Steganography algorithm must be robust against statistical attacks It describes robustness feature.

D. Security

The most important feature of any steganographic algorithm is security. The embedding process should have high security with minimum vulnerability to attacks. Several approaches) have been proposed to secure message in steganography [10].

F. Perceptual Quality

Increment in embedding capacity may also lead to degradation of video quality or degradation of original contents of video. Video steganography approach must handle control degradation of video quality.

Generally the video steganography technique classified based on compressed domain (compressed , uncompressed video) , Embedding domain (spatial domain , transform domain) , classification based method(format based , video codec based).The message embedding process based on two techniques i.e. spatial domain based and transform domain based.

2.1 Spatial Domain Video Steganography

There are many methods of spatial steganography, all directly change some bits in the image of frame pixel values in hiding data. Some methods which are widely used for video steganography based on spatial domain are as follow:

A. Least significant bit (LSB): It is one of the most common and easiest method for message hiding. In this method, message is hidden in the least significant bits of image pixels. Changing the LSB of the pixels does not introduce much difference in the image and thus the stego image looks similar to the original image. The hiding capacity can be increased by using up to 4 least significant bits in each pixel which is also quite hard to detect [13, 14, 15]. This method has high embedding payload, high visual quality, high dtectability.

B. Most Significant Bit (MSB): In this method the messages are embedded into cover image by replacing the most significant bits of the image directly. The visual quality is decreased.

C. Pixel Value Differencing (PVD): In this method the pixel value difference is considered for embedding process. The number of embedded bits is determined by the difference between the pixel and its neighbour. The larger the difference amount is, the more secret bits can be embedded. This method has high imperceptibility and low embedding payload.

D. RGB based Steganography: In this method a digital image is an array of numbers that represent light intensities at various points or pixels. Digital computer images can be normally stored as 24-bit (RGB) or 8-bit (Grayscale) files. A 24-bit file can be quite large however it provides more space for hiding information. As we know all colors are essentially combinations of three primary colors: red, green, and blue. Every primary color is represented by one byte ie every pixel represents a combination of (R, G, B). The parity bit patterns can correspond to the message being hidden. RGB Steganography method attempts to overcome the problem of the sequential fashion and the use of stego-key for the selection of pixels.[16].

2.2 Transform Domain Video Steganography

Transform domain technique is basically used for transforming pixel from time domain to frequency domain. Digital image is collection of pixels which are present in high and low frequency components of image. The edge pixels are high frequency pixels and non edge pixels are low frequency pixels. Generally there are different transformation techniques i.e. Discrete Cosine Transform(DCT) , Discrete Wavelet Transform(DWT) , Discrete Fourier Transform(DFT), Integer Wavelet Transform(IWT), Haar Transform, Discrete Curvelet Transform(DCVT). But DCT and DWT are widely used for steganography.

A. Discrete Cosine Transform (DCT): In this technique embedding process is depended on DCT coefficients. Any DCT coefficient value above proper threshold is a potential place for insertion of secret information. Here the MSB of secret message are hidden in LSB of only those pixels of cover video whose DCT coefficient value is greater than a certain threshold value. It separates the image into spectral sub-bands with respect to its visual quality, i.e. high, middle and low frequency components. It is more suitable for low subband of frequency.

B. Discrete Wavelet Transform (DWT): This technique main advantage is temporal resolution. In it wavelets are discretely sampled. There are two operations one is horizontal and second is vertical. At first, scan the pixels from left to right in horizontal direction. Then, perform the addition and subtraction operations on neighboring pixels. Store the sum on the left and the difference on the right .Repeat this operation until all the rows are processed. The pixel sums represent the low frequency part denoted as symbol L while the pixel differences represent the high frequency part of the original image denoted as symbol H. Secondly; scan the pixels from top to bottom in vertical direction. Perform the addition and subtraction operations on neighboring pixels and then store the sum on the top and the difference on the bottom. Repeat this operation until all the columns are processed. Finally we will obtain 4 sub-bands denoted as LL, HL, LH, and HH respectively. The LL sub-band is the low frequency portion and hence looks very similar to the original image.

III. RELATED WORK

There have been many researchers who have attempted in video steganography system. Mostly they focused on improving embedding process by increasing hidden capacity, robustness and visual quality of video steganography system. The problem is increasing hidden capacity the visual quality of stego video is decreased so this research is focused on increasing hidden capacity without decreasing visual quality of stego video.

Table -1: Comparison of Implemented TechniquesFor Video Steganography

Sr. No	Title	Method Used	Advantages	Disadvantages
1	A High Payload Video Stegnography algo in DWT Domain based on BCH (15, 11)	BCH(15,11) and 2D-DWT is used	Better performance in terms of high embedding payload and robustness	Security is less and improved embedding payload w.r.t. visual quality in frequency domain
2	A DCT-based Robust Video Steganographic Method Using BCH Error Correcting Code	BCH(7,4) and DCT is used	Provides high payload with minimal tradeoffs and high robustness	Improved embedding payload w.r.t. visual quality in frequency domain
3	A Highly Secure Video Steganography using Hamming Code (7, 4)	Hamming code(7,4) and Linear block code is used	Improved Visual quality, , Security	Increased Computational complexity because for providing more security 3 keys are used.
4	Video Steganography Algorithm Based on Trailing Coefficients	DCT and trailing coefficients is used	Provides large capacity of steganography due to trailing coefficients and high robustness	Improved visual quality in terms of PSNR
5	Robust video steganography algorithm using adaptive skin tone detection	Blind adaptive data hiding algorithm for video file	Provides high imperceptibility, high robustness against MPEG 4 compression	Increases hidden capacity by using RDWT

Here Table 1 provides the information about the method used and also include about the advantages and disadvantages of each and every methods.

IV. TECHNIQUE STUDY OF PROPOSED METHOD

In existing system [1] SVD and advance LSB is added for improving embedding process. In proposed system applied SVD transformation on LL subband for increasing visual quality of stego videos and Advance LSB is used for increasing hidden capacity.

A. Singular Value Decomposition (SVD)

SVD has one main property is good stability which means when a small value is added to an image it does not affect visual quality .So, in proposed system SVD is used for handle variation or maintaining visual quality while message is embedded inside cover video. This technique decompose a matrix in three matrices: U, S and V according the equation below:

$$A = USV^T$$

Where A is the original matrix, S is a M x N diagonal matrix of the Eigen values of A, these diagonal values are also called the singular values. U and V are orthogonal matrices M x M and N x N respectively. U is the matrix that the columns are called the left singular vectors and the V columns are the right singular vectors of A.

B. Advance LSB

The LSB embedding technique suggests that data can be hidden in the least significant bits of the cover image and the human eye would be unable to notice the hidden image in the cover file. Generally there should be 2 bit

LSB or 3 bit LSB is used. The LSB is said to be advance because it is 4 bit LSB. In proposed system advance LSB is improving the hidden capacity.

V. PROPOSED WORK

As seen all the methods that are invented in LSB, most of the method suffers through about the capacity,robustness and distortion created by embedding bit into video file. In order to enhance the robustness with maintaining perceptual transparency and improve visual quality, a new video steganographic technique has been proposed and following are the steps.SVD is used for improving imperceptibility of stego video and combination of SVD and 2D-DWT provides high robustness, better imperceptibility and high hidden capacity.

A. Embedding Process:

Step 1:At Sender side, take secret message as input which is embedded in cover medium
Step 2: Change the pixel position of message using key for converting message in unreadable form.
Step 3: Convert the message in 1D array
Step 4:Encode the message using BCH(15,11) encoder.
Step 5: Take video as input which act as cover medium
Step 6: Segmented video into N number of frames
Step 7:On each frame apply 2D-DWT transformation that divide each frame in low, middle and high frequency subband then on LL subband apply SVD.
Step 8:Embedding message into middle and High frequency coefficients (LH, HL, LL) using advance LSB method i.e. 4 bit LSB method.
Step 9: Apply inverse 2D DWT on each frame
Step 10:Regenerate Stego frame
Step 11: Reconstructed stego video as output by rearranging all embedded stego frames.

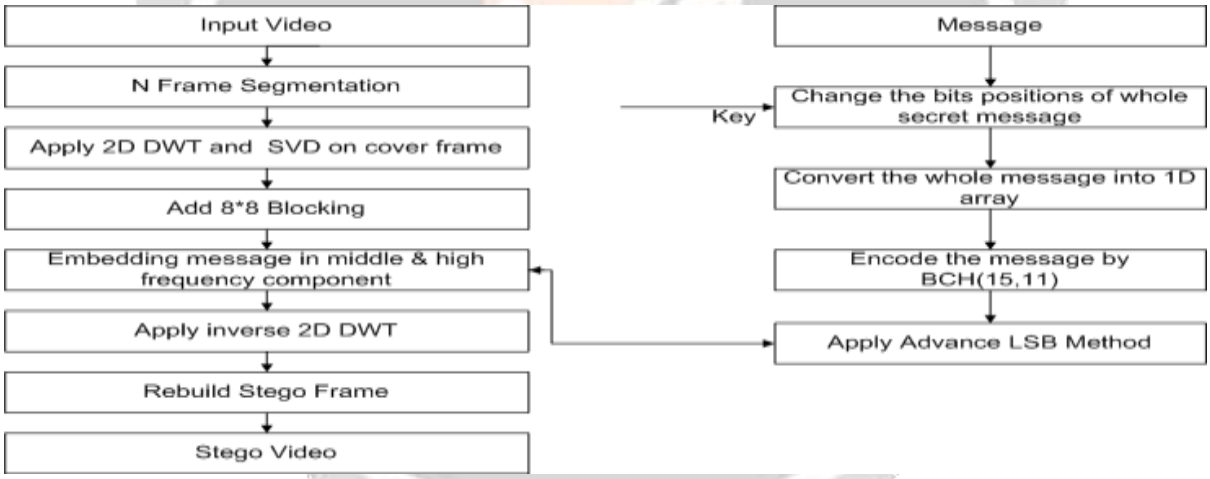

Fig -2: Proposed embedding approach

B. Extracting Process:

Step 1:At Receiver side , stego video is taken as input
Step 2:Segmented stego video into N number of stego frame
Step 3:Apply 2D-DWT on each stego frame that is segmented each frame into low, middle and high frequency subband then on LL subband apply SVD
Step 4:Extract the message from middle and high frequency coefficients (LH, HL, HH) of each frame
Step 5:Apply advance LSB method i.e. 4 bit LSB method on extracted message. The extracted message is in encoded form.
Step 6:Decode the message using BCH(15,11) decoder.
Step 7:Reposition of message again to original bit using same key as sender side
Step 8:Extracted secret message from stego video as output received.

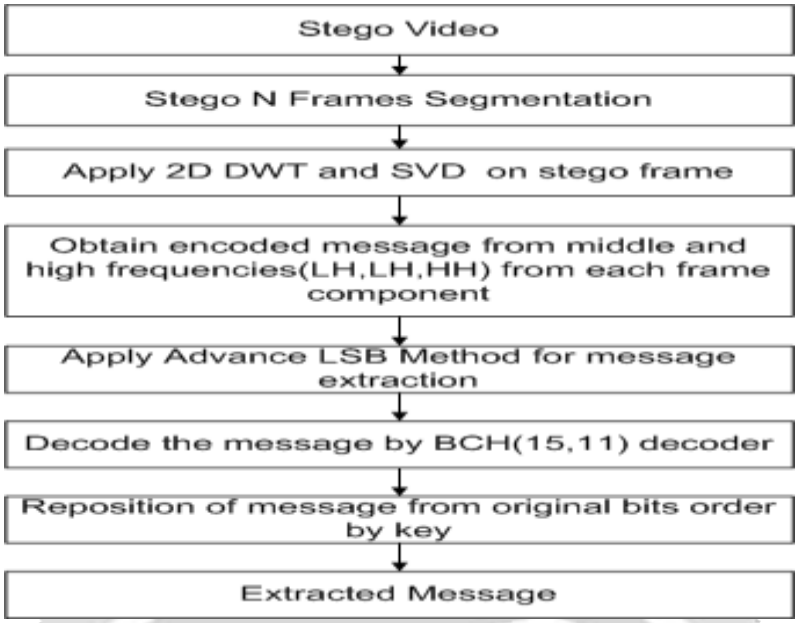

Fig -3: Proposed extracting approach

VI. RESULT ANALYSIS

For implementation of proposed video steganography system has been experimented through Matrix Laboratory (MATLAB) software which is running on laptop with a 2 GHz Core2duo with 2GB RAMand windows 8 operating system.For experiment 7 different video sequences i.e. Akiyo, Bus, Coastguard, Container, Foreman, Soccer, Tennis is taken. The PSNR of existing video steganography system for same 7 video sequences is ranged between 35.58-45.68 dB and the PSNR of proposed video steganography system for same 7 video sequences is ranged between 58.0127-59.2129 dB. Even Hidden Ratio(HR) of existing system in 28.12% which is improved in proposed system. The HR of proposed system is 33% .The result of those sequences in terms of HR and PSNRis given below:

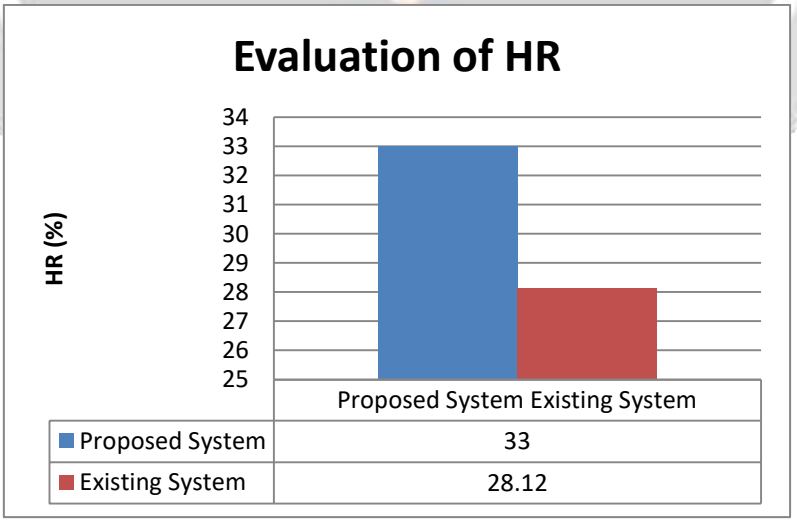

Fig -4: HR Comparison Graph

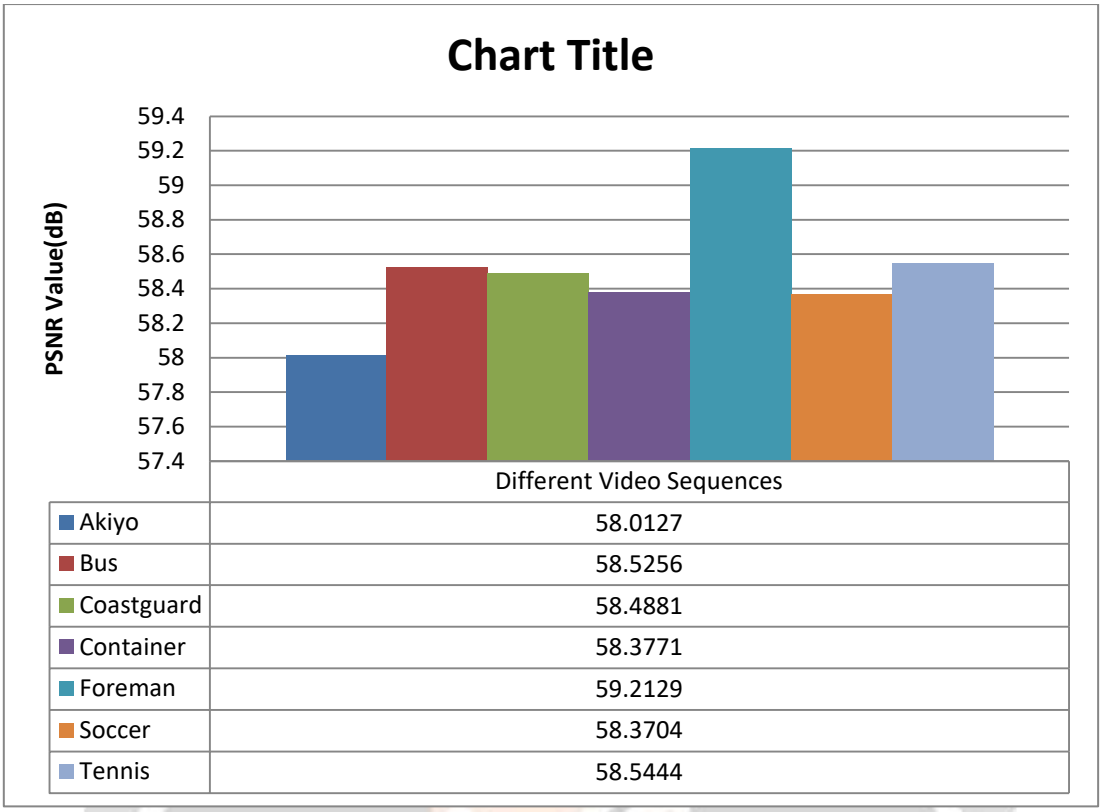

Fig -5: Proposed PSNR graph for different video sequences

VII. CONCLUSION

There are number of issues related to video steganography i.e. robustness, security, hiding capacity, compression and decompression etc. In proposed method we used advance LSB approach for embedding process i.e. improved performance of steganography system in terms of visual quality and robustness. Because advance LSB works on 4 bit LSB which is improved hidden capacity in terms of HR as well as SVD is used which is improved visual quality of stego video in terms of PSNR and 2D-DWT is used which is improved robustness against various attacks .so it is provided high robustness and high visual quality and high hidden capacity .

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