International Journal of Advance Research in Science and Engineering
Vol. No.6, Issue No. 09 , September 2017
www.ijarse.com
IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

High Capacity Video Stegnography Based on BCH Codes in DWT Domain

Miss. Nehali Pawar[1], Prof. Kishor Pandyaji[2]

[1]*ME student, Department of electronics engg, PVPIT, Budhagoan, Maharashtra, (India)*

[2]*Associative Professor, Department of electronics engg, PVPIT, Budhagoan, Maharashtra, (India)*

ABSTRACT

Video stegnography is a method of hiding data in video cover file. The video stegnography is one of the best methods for secret data hiding which reduces the chance of secret message hacking while doing the communication over the internet. High capacity video stegnography based on BCH code in DWT domain is one of the secure methods for data hiding. The proposed system mainly divided into two parts namely, data embedding and data extraction. In data embedding, secret message is encoded by BCH code for more secure and robust communication and encoded message is embedded in DWT coefficients of video frames. The secret message is only embedded in middle and high frequency regions of DWT. The performance of this algorithm is mainly depends upon two factors: Embedding payload and embedding efficiency. The results of this proposed system is discussed on the basis of parameters like visual quality, embedding payload, robustness. The proposed system performance is better than the existing techniques of video stegnography.

Keywords: BCH code, DWT, Embedding payload, security, Stego video, Video Stegnography, Visual quality.

I.INTRODUCTION

Stegnography is a Greek word which means the covered writing. Video stegnography is an art of hiding data in video media. The secrete message may be text, image, audio, video. The best technique is to hide the secret data without reducing the quality of the cover video, so that it cannot be detected by naked eyes. The embedded video is known as the "stego" video which is sent to the receiver side by the sender. Block diagram of video stegnography is shown in fig1.

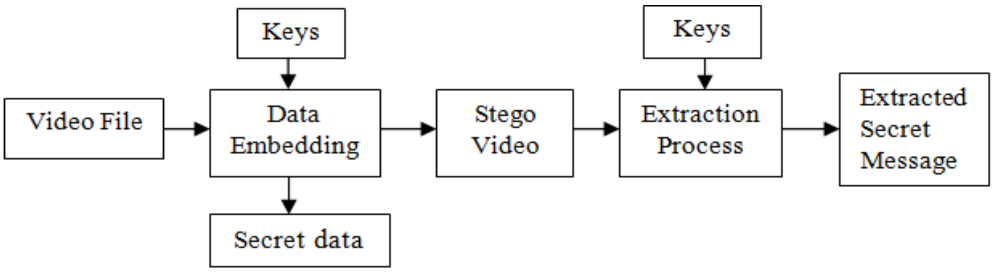


Fig1: Block Diagram of Video Stegnography [1]

Video based stegnographic techniques are broadly classified into temporal domain and spatial domain. In frequency domain, data are transformed to frequency components by using FFT, DCT or DWT and then embedded in some or all of the transformed coefficients. In spatial domain, the bits of data can be embedded in

IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

intensity pixels of the LSB positions of the video. Video stegnography used various types of algorithms for data encoding. Efficiency of particular algorithm is decided by its performance parameters.

II. DISCRETE WAVELET TRANSFORM

Discrete Wavelet Transform is standard method that transfer signal from time domain to transform domain at different frequency bands. DWT splits signal into high and low frequency parts. In proposed system 2D-DWT is used for image decomposition. DWT transform is applied to an image it is decomposed into four sub bands namely LL, HL, LH and HH this is first level decomposition. For performing second level decomposition DWT applied to LL1 band which further divided into 4 sub bands shown in fig2.

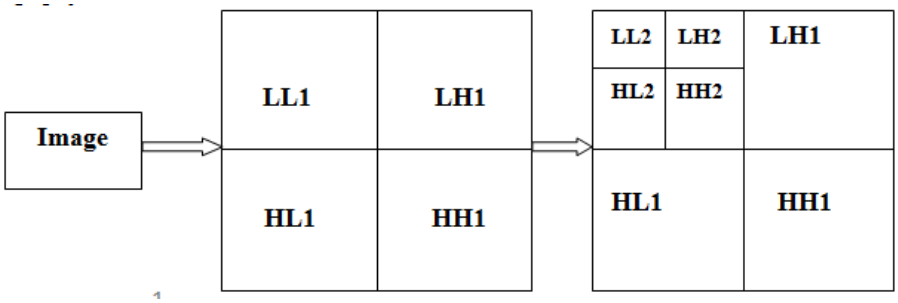


Fig.2: 2D- DWT

Where, LL(approximation), LH(horizontal), HL(vertical), HH(diagonal) are four sub bands get after decomposition process. Secret message only hide in LH, HL and HH bands of the image because they gives detailed frequency coefficients of image. LL is a low frequency sub band which is an approximation of original image so it is not used for data hiding.

In proposed system, secret message is encoded by BCH code is covered by LH, HL, HH frequency bands of the image from video.

III. BCH Codes

The BCH abbreviation is stands for the discovers, Bose and Chauduri (1960), independently Hocquenghem (1959). These are multiple error detecting and correcting codes. BCH code (n, k, t) is a binary code with codeword length 'n' that is n ($c_0, c_1, c_2, \ldots\ldots, c_{n-1}$) and message length k ($a_0, a_1, a_2 \ldots\ldots, a_{k-1}$). The error correcting bits are denoted by 't'. BCH (binary) codes may also be considered as a binary group code, where the necessary and sufficient conditions to be satisfied are:

(a) For any positive integer $m \geq 3$ and $t < 2^{m-1}$ the parameters for the BCH code is as follows:

- Block codeword length $n = 2^m - 1$
- Message length k
- Maximum correctable error bits t
- Minimum distance $d \geq 2t + 1$
- Parity check bits $n - k \leq mt$

Parity check matrix is denoted by H. The parity check matrix for BCH code is described as follow:

International Journal of Advance Research in Science and Engineering
Vol. No.6, Issue No. 09 , September 2017
www.ijarse.com
IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

$$H = \begin{bmatrix} 1 & \propto & \propto^2 & \propto^3 & \dots & \propto^{n-1} \\ 1 & \propto^3 & (\propto^3)^2 & (\propto^3)^3 & \dots & (\propto^3)^{n-1} \\ 1 & \propto^5 & (\propto^5)^2 & (\propto^5)^3 & & (\propto^5)^{n-1} \\ \vdots & \vdots & \vdots & \vdots & \dots & \vdots \\ 1 & (\propto^{2t-1}) & (\propto^{2t-1})^2 & (\propto^{2t-1})^3 & & (\propto^{2t-1})^{n-1} \end{bmatrix} \quad \dots (1)$$

This parity equations consists of roots like, α, $\propto^2, \propto^3 \dots \propto^{2t}$ Etc. On the basis of that roots generator polynomial g(x) is calculated. The equation for Generator polynomial is as fallows

$$g(x) = lcm\{M_1(x), M_2(x), M_3(x), \dots, M_{2t}(x)\} \quad \dots (2)$$

$$g(x) = M_1(x), M_3(x), M_5(x), \dots, M_{2t-1}(x) \quad \dots (3)$$

The generator polynomial g(x) will be the polynomial of the lowest degree in the Galois Field GF (2), with roots α, $\propto^2, \propto^3 \dots \propto^{2t}$ Etc on the condition of α is primitive of GF (2^m).

This mathematical base is used to implement this data hiding video stegnography technique.

IV. PROPOSED SYSTEM

The proposed system is high capacity video stegnography based on BCH code in DWT domain. This system gives idea about data hiding. The proposed system is enclosed by the two processes that are data embedding process and data extracting process.

1.1 Data embedding process

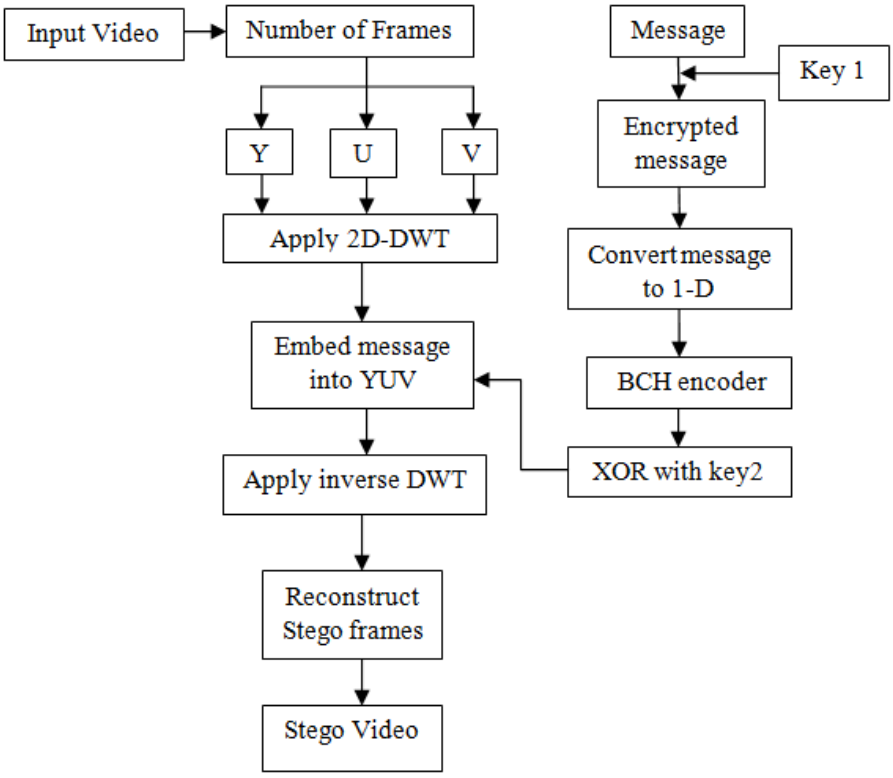


Fig3: Data embedding process

The data embedding process consist of two phases: 1) Encode the message using BCH code (steps 1 to 5)

2) Embed the encoded message into the cover video (Steps 6 to 13). This process consists of fallowing steps:

1. Input secret message.

IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

2. By using key1, change the bit positions of secret message.
3. Convert this secret message into 1-D array.
4. By using BCH encoder, encode the secret message.
5. XOR the encoded data by using key 2.
6. Input the cover video.
7. Framing of input video
8. Separate each frame into YUV color.
9. Apply 2D-DWT to Y, U and V separately.
10. Embed message in Y, U and V.
11. Apply inverse 2D-DWT on frames.
12. Rebuild the stego frames from YUV components.
13. Reconstruct the stego video from all stego frames.

1.2 Data extracting process

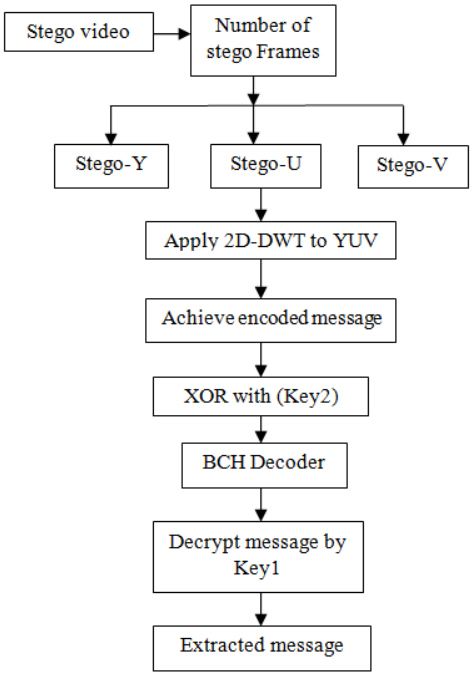


Fig.4: Data extracting process

The data extraction process which separate the secret message from cover video with the help of BCH decoder. The steps for data extraction process are as fallowing:

1. Input the stego video.
2. Framing of stego video.
3. Convert stego frames into YUV components.
4. Apply 2D-DWT to YUV color components.
5. Obtain encoded message from middle and high frequency components.
6. XOR the encoded message with key 2 which is generated by sender side.
7. Decode message by BCH decoder.

IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

8. By using key1 reposition the message bits to get original message.
9. Output as a secret message.

V. PERFORMANCE PARAMETERS

5.1 Visual Quality

This parameter is used to find out the visual quality of stego video. Visual quality is decided by the value of PSNR, shown in equation (2).

5.1.1 Mean Square Error

MSE measures the average of the squares of the 'Error'. It is the average squared difference between a cover image and stego image.

$$MSE = \frac{\sum_{i=1}^{m}\sum_{j=1}^{n}\sum_{k=1}^{h}[C(i,j,k)-S(i,j,k)]^2}{m*n*h} \qquad (1)$$

Where, C and S are refer as cover image and stego image respectively. In addition, m and n are defined as video resolutions and h indicates the R, G and B color channels (k=1, 2 and 3).

5.1.2 Peak Signal to Noise Ratio (PSNR)

PSNR ratio is used to find out the visual quality of the proposed video stegnography method. PSNR is an objective quality measurement used to calculate the difference between the original and the stego video frames. PSNR is usually expressed in terms of the logarithmic decibel scale.

PSNR is most easily defined through the mean squared error (MSE). It is expressed by,

$$PSNR = 10 * \log_{10}\left(\frac{{MAX_0}^2}{MSE}\right) \qquad (2)$$

Where, MAX_0 is maximum intensity of image. Typical value for the PSNR is 30 to 50 dB, where higher value of PSNR is always better.

5.2 Embedding Payload

Embedding payload is the maximum amount of data can be embedded into the cover file without losing the quality of the original file. Embedding payload of any video stegnography technique is decided by Hiding Ratio (HR).

Hiding Ratio (HR) is expressed by,

$$HR = \frac{Size\ of\ embedded\ message}{Video\ size} * 100\% \qquad (3)$$

VI. RESULTS AND DISCUSSION

The results for data embedding are calculated on the basis of parameters like embedding payload and visual quality. Embedding payload means embedding capacity of cover video. This embedding payload is used to calculate the embedding efficiency of video. The visual quality is another important parameter which depends upon mean square value and PSNR value. The PSNR should be between 30 to 50 dB, where higher value is always better. The results for data embedding in cover video are shown fallowing figures.

The image extracted from cover video for secret message hiding. The Grapes.AVI video is selected for the secret message hiding shown in fig5.

International Journal of Advance Research in Science and Engineering
Vol. No.6, Issue No. 09 , September 2017
www.ijarse.com
IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

Fig5.Original Frame no.25 in Grapes.AVI Video

The extracted frame sepreted into YUV components by using DWT. The DWT gives detailed frequency coefficients of image which shows LL, LH, HL and HH regions of image shown in fig6.

Fig6: Detailed frequency coefficients of YUV components of original image by using DWT

The output parameters of cover video and stego video are shown in fig7. Cover video gives details of number of rows, columns, planes and frames. The quality parameters for stego video such as PSNR, MSE, embedded bits, HR and time elapsed also shown in fig7.

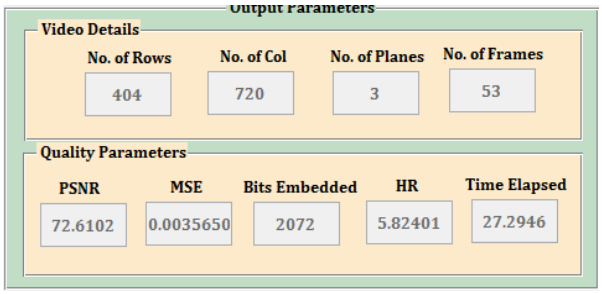


Fig7: Output parameters on data embedding side for Grapes.Avi

Data embedded in extracted frame gives stego frame which is shown in fallowing fig8.

Fig8: Stego frame no.25 in Grapes.AVI video

Again, DWT applied to stego frame to seprete the YUV components which gives Detailed frequency coefficients of YUV components of stego image shown in fallowing fig9.

Fig9: Detailed frequency coefficients of YUV components of stego image by using DWT

The recovered secret message is shown in fig10.

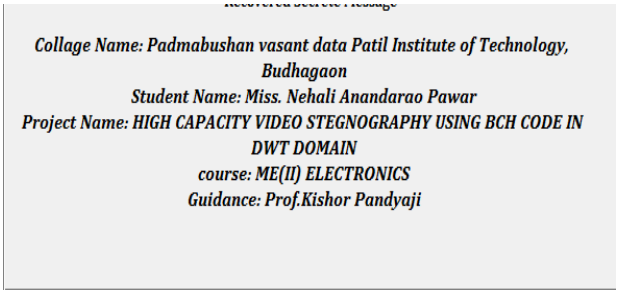


Fig10: Recovered secret message

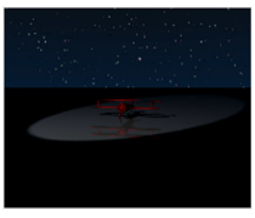
Some videos are considered for data hiding in the praposed system shown in the fallowing figure11. The frames are extracted from the respective cover videos and secret message is hide under these frames. The difference between original frame and stego frame is calculated by the MSE parameter.

Frame no 45 in *Ball* video

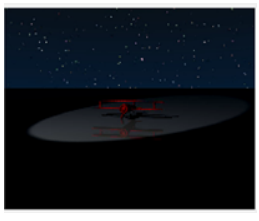
Stego Frame no.45 in *Ball* video

Frame no 25 in *Grapes* video

Stego Frame no.25 in *Grapes* video



Frame no.12 in *Toy-plane* video



Stego Frame no.12 in *Toy-plane*

International Journal of Advance Research in Science and Engineering
Vol. No.6, Issue No. 09 , September 2017
www.ijarse.com
IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346


Frame no.2 in prpol-rerender Stego Frame no.2 in prpol- rerender video

Fig11: Results for different videos.

The results for the ball.AVI video for different embedding bits are shown in table1. The data embedded into video is increased, PSNR value is reduced. Reduced value of PSNR degrades the visual quality of video. The hiding ratio and time required for data hiding is also increased. The difference between original video and stego video is calculated by MSE. The less value of MSE shows similarity between original video and stego video.

Table1: Comparative study of Grape.AVI video for different embedding payload

Sr. No	Technique	Cover video	Video Resolution	No. of Frames	Frame No.	Embedding Payload	MSE	PSNR	Hiding Ratio
1.	High capacity video stegnography based on BCH code in DWT domain	Grapes.AVI	404*720	53	25	440	0.0007	79.13	1.23
						496	0.0008	79.03	1.39
						2072	0.003	72.61	5.82
						6568	0.011	67.61	18.4
						13760	0.023	64.42	38.6

VII. CONCLUSION

In this paper, a high capacity video stegnography based on BCH code in DWT domain has been proposed. This proposed algorithm decomposes the cover video into number of frames; then it divides each frame into YUV component. 2D-DWT has been applied to YUV components of frame; both middle and high frequency coefficients (LH, HL and HH) are selected for secret data embedding. The secret message is encoded by BCH encoder. This encrypted message is embedded into selected frequency coefficients of YUV component of frame. Data extraction process is exact opposite of data embedding process which helps to get recovered secret message.

This proposed algorithm used BCH encoder which increases the efficiency of algorithm. Two keys are used for protection of secret message which enhanced the security of system. The visual quality of video is also high: this system gives above 50dB PSNR for AVI video. Various results are conducted for Different AVI videos shown in fig.11 and results for different embedding payload shows variation in PSNR value which shown in table1.

IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

VIII. ACKNOWLEDGEMENT

I would like to express my special thanks of gratitude to my project guide Prof. K. K. Pandyaji who gave me valuable guidance, clean interest and encouragement to do this project work. Secondly I would like to thank Electronics department (PVPIT, Budhagoan) of my college which also helped me in doing this project. I am also thankful to my parents and friends who helped me a lot in finishing this project within the limited time.

REFERENCES

[1] Nehali Pawar, Kishor Pandyaji, "Data hiding technique in video stegnography using BCH codes in DWT domain", in *International Journal of Scientific Research and Development (IJSRD), ISSN: 2321-0613, Vol.5, Issue 4,2017*

[2] Nehali Pawar, Kishor Pandyaji, "Comphrensive study of video stegnography algorithms." in *International Journal of Engineering Science and Computing (IJESC), ISSN: 2321- 3361, vol.7, Issue 3, March 2017*

[3] M. E. Eltahir, L. M. Kiah, and B. B Zaidan, "High Rate Video Streaming Steganography", in *Information Management and engineering,(ICIME). International conference on, 2009, pp. 550-553.*

[4] R. Shanthakumari and Dr.s. Malliga, "Video Steganography Using LSB Matching Revisited Algorithm", in *IOSR Journal of Computer Engineering (IOSR-JCE) e-ISSN: 2278-0661, p-ISSN: 2278-8727, Volume 16, Issue 6, Ver. IV(Nov-Dec. 2014), pp 01-06.*

[5] Hemant Gupta and Dr. Setu Chaturvedi, "Video Stegnography through LSB based hybrid approach", in *International Journal of Engineering Research and Development, Volume 6, Issue 12 (May 2013), pp. 32-42.*

[6] ShengDun Hu, KinTak U, "A Novel Video Stegnography based on Non-uniform Rectangular Partition", in *International Conference on Computational Science and Engineering, pp 57-61, Aug.2011*

[7] R. J. Mstafa and K. M. Elleithy, " A highly secure video stegnography using Hamming code (7, 4)" in *Systems, Applications and Technology Conference (LISAT), 2014 IEEE Long Island, 2014, pp. 1-6*

[8] Ms. Pooja Vilas Shinde and Dr. Tasneem Bano Rehman, "A Survey: Video Stegnography techniques" in *International Journal of Engineering Research and General Science ISSN 2091-2730 Volume 3, Issue 3, May-June, 2015.*

[9] Syeda Musfia Nasreen,et al.,"A Study on Video Stegnography Techniques" in *International Journal of Computational Engineering Research (IJCER), ISSN (e): 2250 – 3005, Vol 05, Issue 10, October – 2015.*

[10] K. Parvathi Divya,et al., "Various Techniques in Video Stegnography – A Review", in *International Journal of computer and Organization Trends, ISSN: 2249-2593 ,Volume-5, February-2014.*

[11] Ramadhan J. Mstafa and khaled M. Elleithy, Senior Member, IEEE, "A High Payload Video Stegnography Algorithm in DWT Domain Based on BCH Codes (15, 11)" in *Department of Computer Science and Engineering University of Bridgeport, CT 06604, USA, 2015*