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Implementation of Discrete Wavelet Transmission for Color Image Transmission in OFDM

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Abstract— Orthogonal frequency division multiplexing technique is most widely used for high speed broadcast purposes & it is one of the most useful technologies for the present and future wireless communications. The data bits are encoded to multiple sub-carriers using multicarrier modulation technologies when being sent simultaneously A modified Orthogonal Frequency Division Multiplexing (OFDM) system for robust progressive image transmission is analyzed .In this paper an image frame is compressed using DWT, and the compressed data is arranged in data vectors ,each with equal no. of coefficients. the simulation results are presented based on bit error rate (BER), the Peak-signal-to-noise ratio (PSNR) over AWGN channel. Based on the simulation outcome, to the color image and different parameter like PSNR,BER,SNR.

Keywords—Orthogonal Frequency Division Multiplexing (OFDM),Binary Phase Shift Keying (BPSK), Wavelet Source Coding ,Adaptive White Guassian Noise Channel(AWGN),Discrete Wavelet Transform (DWT), Peak Signal to Noise Ratio (PSNR),Bit Error Rate (BER).

1.Introduction

Orthogonal Frequency Division Multiplexing (OFDM) introduced in the year 1960, based on the multicarrier modulation techniques used in high frequency range for military application. In the year 1971, the basic idea created based on Discrete Fourier Transform (DFT) for the implementation of OFDM and removing the requirement for banks in the analog subcarrier oscillators [1] .Each FDM channel is separated from the others by a frequency guard band to reduce interference between adjacent channels. With the advance of communications technology comes the demand for higher data rate services such as multimedia, voice, and data over both wired and wireless links . Even though the Wireless Communication Systems like OFDM can reveal efficient bandwidth it makes deteriorate effect on performance by multi-path fading channels. Forever, to enhance the performance there is a need in development to recognize the system in addition a well organized channel estimation and equalization methods [2]. The relevant sub-carrier casing Inter Symbol Interference (ISI) in addition with unlike sub-carriers casing Inter Carrier Interference (ICI) will have self-interference occur along with successive symbols in the dispersive channel. This is avoided in time-invariant frequency-selective channel [5]. In this project ,the proposed work based on the color image transmission with the help of OFDM(Orthogonal Frequency Division Multiplexing) and DWT (Discrete Wavelet Transform). Here we are using OFDM because we know that OFDM is a multicarrier transmission scheme and high data bit rate .Also it is used to high spectral efficiency to reduce ISI(Inter-symbol-Interference) effect. So it takes more size of images. The basic concept behind for using Wavelet Transform is that it is convert the image in both the form of time and domain frequency. So concluded it can reduces the size of images and it can be only transmitted the information of the image[3]. As final result we get to the color image and different parameter like PSNR,BER and SNR and comparison different values. An OFDM signal is obtained by adding up all the N modulated independent sub carriers, Where N is number of sub carriers. The sub carriers are selected to be orthogonal such that the adjacent sub carrier division f= 1/T .where T is OFDM symbol duration. The mathematical representation of OFDM signal can be written as .

$$x(n) = \frac{1}{\sqrt{N}} \sum_{k=0}^{N-1} X_n e^{j2\pi \frac{k}{LN} n},$$

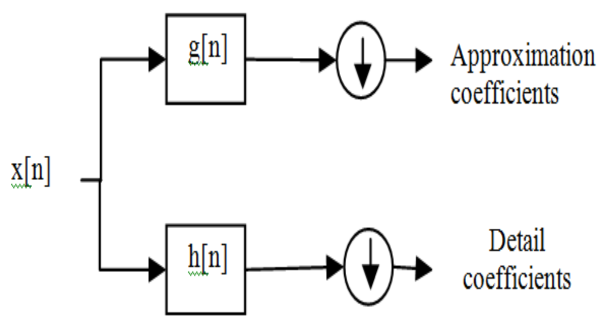
$n = 0, 1, 2, 3, \ldots., LN$ Where N is number of sub carrier & L is oversampling factor.

MOTIVATION FOR USING WAVELETS

- There are several advantages of using wavelets for wireless communication systems. The few desirable features of wavelets are the following:
- .Wavelet transform can create subcarriers of different bandwidth and symbol length.
- The ability of wavelets to arrange the time frequency tiling in a manner that minimizes the channel disturbances minimizes the effect of noise and interference on the signal.
- Wavelets give a new dimension, signal diversity which could be exploited in a cellular communication system, where adjacent cells can be designated different wavelets in order to minimize inter-cell interference.
- Wavelet-based algorithms have long been used for data compression. By compressing the data, are reduced volume of data is transmitted so that the communication power needed for transmission is reduced..
- The wavelet transform allows more flexibility in the design of the pulse shape. Many researchers proved that the wavelet based multi –carrier schemes are superior in suppressing ICI and ISI as compared to the traditional Fourier based systems.

WAVELET TRANSFORM BASED ON DWT OFDM

In DWT, the signal is decomposed into approximation and detail information by successive high-pass and low-pass filtering of the original time domain signal. This decomposition is done to analyze the signal at different frequency bands with different resolutions. The original N signal x[n] is passed through a low-pass filter g[n] to N obtain approximation coefficients and a high-pass filter h[n] to obtain detail coefficients as shown in figure.



In Wavelet based OFDM (DWTOFDM),the time-windowed complex exponentials are replaced by wavelet “carriers", at different scales (j) and positions on the time axis (k). These functions are generated by the translation and dilation of a unique unction, called "wavelets mother" and denoted by ψ (t):

$$\varphi_{J,K}(t) = 2^{-j/2}\, \varphi(2^{-j} t - k) \qquad (1)$$

The scale index (j) and time location index (k) affects the orthogonality of the subcarriers and exhibits better time frequency localization as compared to the complex

exponentials used in FFT based OFDM systems [3]. The orthogonality is achieved if it satisfies the following condition, according to equation .

$$\langle \varphi_{j,k}(t).\varphi_{m,n}(t) \rangle = 1,\ j{=}m\infty\ k = n \qquad 0,\ \text{otherwise} \qquad (2)$$

the scaling function □ □ is used to obtain a finite number of scales and is generated using equation .

$$\varphi_{J,K}(t) = 2^{j/2}\, \varphi(2^{j} t - k) \qquad (3)$$

Higher the value of □, higher is the resolution. The lower resolution function, denoted by □ □ can be represented as the weighted sum of shifted versions of some scaling functions at next higher resolution i.e. □ 2 , given by Equation (4),

$$\varphi(t) = \textstyle\sum_k h(k)\sqrt{2}\ \varphi(2t - k) \qquad (4)$$

To better describe the important features of a signal, another set of functions given by $\varphi_{j,k}(t)$ is defined which is also represented in terms of the scaling function, given b y equation (5) as follows,

$$\varphi(t) = \textstyle\sum_k g(k)\sqrt{2}\ \varphi(2t - k) \qquad (5)$$

The set of (*k*)coefficients are known as the wavelet function coefficients.

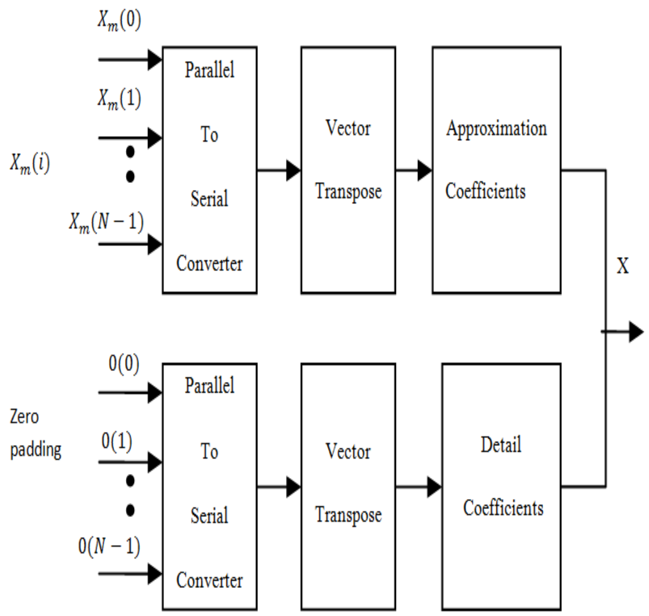


Fig.1 DWT OFDM Transmitter

On the transmitter side, the digital modulator maps the serial data bits into OFDM symbols X_m in the similar way as in FFT-OFDM within the parallel N data streams represented by X_m where $(0 \leq i \leq N-1)$. Each data stream $X(i)$ is passed through serial to parallel converter to create a vector. Then the transpose of this vector is taken to obtain the approximation coefficients which are also known as scaling coefficients. Thus the signal is up sampled and low-pass filtered to achieve the low frequency signals. In the similar way, the vector generated from the zeroes padding signal is convolved with the high-pass filter which contains the detailed coefficients or wavelet coefficients.

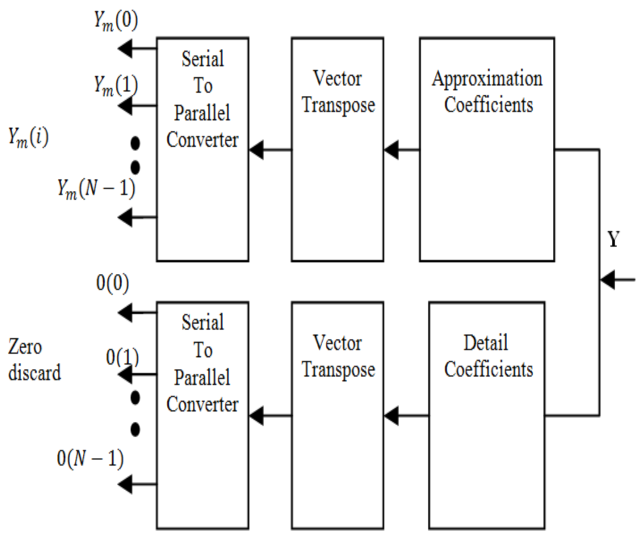
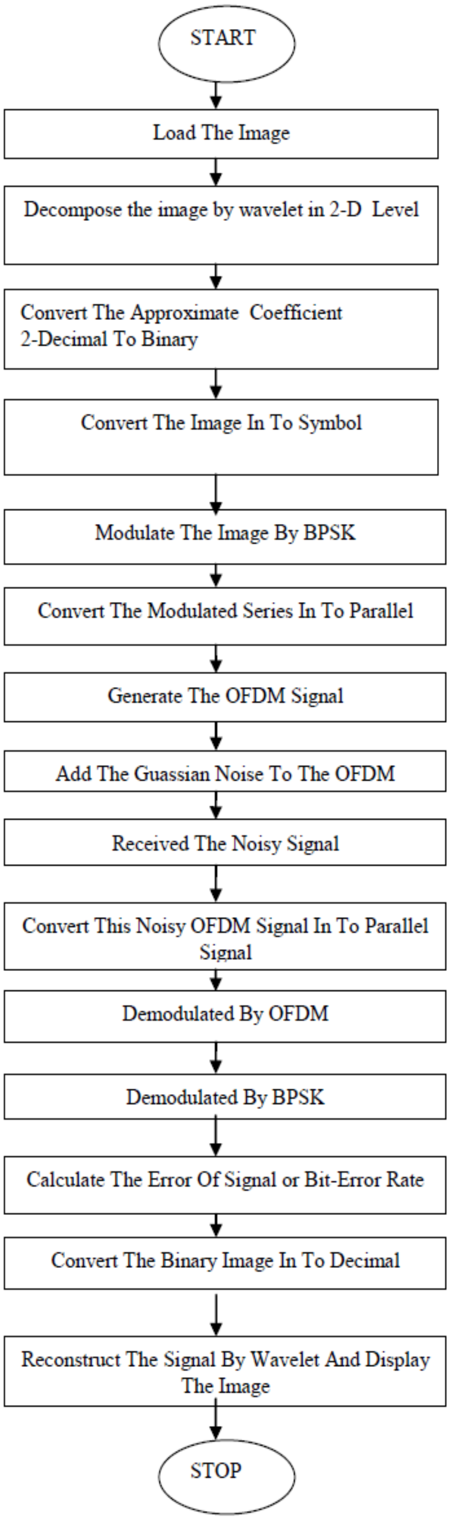


Fig 2 The DWT-OFDM receiver .

It performs the exact reverse process of the transmitter. The received data Y is decomposed into two parts and then sent to the low-pass and high-pass filters to obtain the approximation and detailed coefficients respectively. Only the output of the LPF is passed through the demodulator and the output of the HPF is discarded. Before demodulation, the transpose of data is taken and then passed through a serial to parallel converter. is discarded because it contains only zeroes elements and does not carry any useful information. The original data is recovered at the output of the demodulator [8].

Methodology

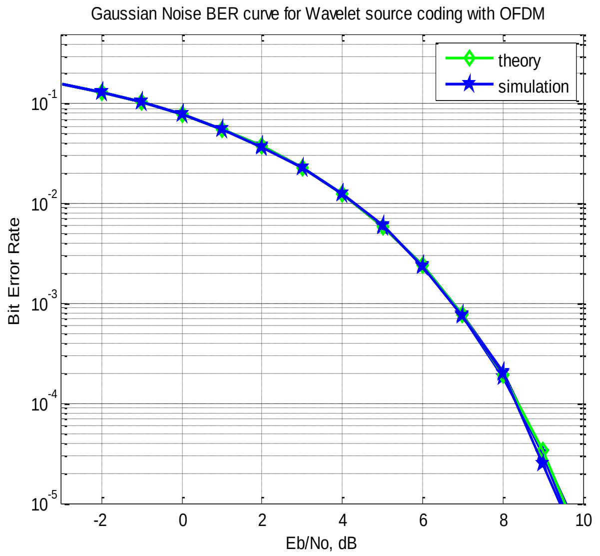


The description of methodology according to used of their different method are following.
Flow chart for energy efficient color image transmission using DWT OFDM system is shown in fig. First we load the image in the input side then decompose the image by Wavelet in Two –Dimensional Level . After that it will be converted in to the approximate coefficient two decimal to binary and for image in to symbol to modulate the image by BPSK because this modulated series is converted in to parallel and add the Gaussian noise to OFDM transmitted signal .At receiver side received noisy OFDM signal is converted in to parallel for demodulating the OFDM and BPSK because we need to calculating the Bit error rate or error signal for convert the image in to decimal form. At final of this flow-chart we will reconstruct the image signal with the help of Wavelet and display the image.

Simulation Result

Fig. No. 3 Transmitted image

Fig. No. 4 Received image



Conclusion and Result

From above result we concluded the DWT has come up as an effective technique to be used in multicarrier modulation because of its good time- frequency localization properties, ICI and ISI suppression and flexibility. Moreover, the cyclic prefix is not used in DWT based OFDM system. The simulation results show that when the DWT-OFDM system is used the BER performance it is improved in AWGN`. Also it shows greater efficiency and good Bit-Error –Rate performance and get the color image

REFERENCES

1. [1] S.Weinstein, and P. Ebert, Data Transmission by Frequency division Multiplexing Using the Discrete Fourier Transform, IEEE Transactions on Communication Technology, Vol. COM-19, No. 5, October 1971,.
2. [2] Won G., Kyung C., and Yong C., "An Equalization Technique for Orthogonal Frequency Division Multiplexing Systems Time-Variant Multipath Channels", Computer Journal of IEEE Transactions on Communications, 1999.
3. [3] Dachuri Lakshmi ,Pujitha and Uppala Nalini, Energy Efficient Color Image Transmission using DWT-OFDM System 2013 Sep.
4. [4] Mr. Anshul Soni,, Mr. S.J. Basha, Mr. Ashok Chandra Tiwari Comparative Analysis of OFDM under FFTand DWT Based Image Transmission.International Journal of Innovative Research in Computer and Communication Engineering, April 2013.
5. [5] IEEE Std.,"IEEE Proposal for 802.16.3, RM Wavelet Based (WOFDM) PHY Proposal for 802.16.3", Rainmaker Technologies, Inc., 2001
6. [6] W. Saad, N. El-Fishawy, S. EL-Rabaie, and M. Shokair An Efficient Technique for OFDM System UsingDiscret]e Wavelet Transform 2010.
7. [7] Lakshmi Pujitha Dachuri, Nalini Uppala Energy Efficient Transmission of Image oveRDWT- OFDM System. International Journal of Electrical, Robotics, Electronics and Communications Engineering , 2013.
8. [8] Rohit bodhe, satish narkhede, shirish joshi,,design of simulink model for OFDM and comparison of FFT And DWT-OFDM 2012.
9. [9] DWT Image Energy-Efficient Transmission of OFDM fading Channel , international journal of emerging trends in technology and sciences , April-2014.
10. [10] Jie Song and K. J. Ray Liu, Robust Progressive Image Transmission Over OFDM Systems Using Space-Time Block Code, ieee transactions on multimediaseptember 2002.
11. [11] Mr. Abhishek gupta, Mr. Prateek nigam, Dr. Vijayshri chau, Removal of Cyclic Prefix in Adaptive OFDM for Dynamic Spectrum Access usingDWT and WT. International journal of engineering sciences & research Technolog,2014.
12. [12] Marius Oltean, Miranda Nafornită, Wavelet OFDM Performance in Frequency Selective Fading Channels, 2010.
13. [13] Mohamed h. M. Nerma, nidal s. Kamel and varun jeoti, BER Performance Analysis of OFDM System Based on Dual –Tree Complex Wavelet Transform in AWGN Channel.
14. [14] Rabindra Bhojray , Sumant kumar Mohapatra, Digital multicarrier modulation techniques for high data rates multimedia applications in present and future wireless communication systems,2013.
15. [15] Matthieu Gautier , Marylin Arndt, efficient wavelet packet modulation for wireless communication.
16. [16] Karanpreet Kaur, Ankush Kansal Performance Analysis of Convolutional Interleaved DWT based OFDM system, International Journal of Advanced Research in Computer and Communication Engineering,2014..
17. [17] Rohit Bodhe, Shirish Joshi, Satish Narkhede, Performance Comparison of FFT and DWT basedOFDM and Selection of Mother Wavelet for OFDM 2012.
18. [18]Keyursinh Thakor, Bhargav Shah, Chintan Panchal, Unequal Power Allocation for Image Transmission,2014.
19. [19] Puneeth.S, Dr. Fathima Jabeen, Optimized Transmission of Images with OFDM over AWGN,International Journal of Emerging Technology and Advanced Engineering 2012.
20. [20] Sivakrishna jajula,, P.V.Ramana , Effects of Nonlinearity on DFT-OFDM and DWT-OFDM Systems International Journal of Engineering Trends and Technology (IJETT) 2013.
21. [21] Kavita Trivedi, Anshu Khare, Saurabh Dixit, Ber performance of ofdm with discrete wavelet transform for time dispersive channel International Journal of Research in Engineering and Technology2014.
22. [22] MoeinShayegannia,Atousa HajShirMohammadi An OFDM Based System for Transmission ofJPEG2000 Images Using Unequal Power Allocation 2012.
23. [23] N. Manikanda Devarajan,, Dr. M .Chandra sekaran A Survey on OFDM Systems based on Wavelets 2014.

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