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PERFORMANCE IMPROVEMENT OF IMAGE DATA COMMUNICATION OVER MIMO-WLAN USING DIFFERENT WAVELET DOMAIN MEDIAN FILTERING TECHNIQUES

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ABSTRACT

In wireless communication, the receiver side bit error rate strongly affected by channels noise, synchronization error, interference, and wireless multipath fading channels, Multiple-input and multiple-output(MIMO). The image is becomes a fundamental data for communication which needs high data rate for transmission. The image transmission over wireless communication system suffers from distortion due to the adverse effect of channel. In a method based on Space-Time Block Coding (STBC) with Multiple-Input Multiple-Output set-up for use in wireless channels. A comparison is made between the diversity gain of MIMO and WLAN systems in terms of BER for High QAM modulation scheme. In this paper, performance of WLAN system is simulated and bit error rate (BER) performance is observed. In BER level is depend on the modulation type, then SNR value and channel behavior. The results has been shown in the paper for the simulation in various conditions.

KEYWORDS: WLAN, MIMO, STBC, Wavlete transform, BER, SNR, PSNR, etc.

INTRODUCTION

Wireless Local Area Networks and the exponential growth of the Internet have resulted in an increased demand for new methods of obtaining high capacity wireless system. Today a wired LAN can offer users high bit rates to meet the requirements of bandwidth consuming services like a video conference, streaming video etc. With this in mind a user of a wireless local area network will have high demands on the system and will not accept too much degradation in performance to achieve mobility and flexibility. Multiple-Input Multiple-Output (MIMO) systems have achieved attention as it promise to increase capacity and performance with acceptable bit error ratio proportionally with the number of antennas. A multiple input multiple output uses multiple antennas at both transmitter and receiver sides. The data encoded at a specific rate like ½ or 2/3 and then is modulated using BPSK/ QPSK/QAM modulation.

In this paper, we first discuss the various Wireless LAN standards. The paper presents in the performance comparison results of the various modulation Techniques for OFDM in WLAN standard IEEE802.11 system a so as to obtain the most Modulation technique for the same. The IEEE 802.11 standard defines both a Multiple Access Control protocol and physical layer implementations at MAC layer; IEEE 802.11 supports both infrastructure and ad hoc networks. Throughout this paper we present the BER performance comparison results over AWGN and Rayleigh fading channel using the digital modulation technique BPSK, QPSK ad QAM for OFDM in IEEE802.11a standard so as to obtain the modulation combination that will give us better performance .There is several modulation techniques are available between the variety of modulation schemes, in OFDM modulation technique is the best. It is a powerful modulation technique used for high data rate, able to eliminate ISI. In OFDM, subcarriers overlap but it does not create any problem. As they are orthogonal that is the peak of one subcarrier occurs when other subcarriers are at zero. These paper discuss the BER Performance of the Rayleigh communication channel under BPSK, QPSK and QAM modulation scheme .we will analyze the SNR and bit error rate(BER) performance through transmit diversity.

MIMO ALAMOUTI SPACE TIME CODING

The transmit diversity technique proposed by Alamouti was the first STBC. The encoding and decoding operation is carried out in sets of two modulated symbols. Hence, the information data bits are first modulated and mapped into their corresponding constellation points. Therefore, let us denote by x1 and x2 the two modulated symbols that enter the space–time encoder.

$$X_1 = \begin{bmatrix} x_1 & -x_2^* \\ x_2 & x_1^* \end{bmatrix} \quad (1)$$

In the coding matrix X1, the subscript index gives the transmit rate compared to a SISO system. For Alamouti's scheme, the transmission rate is 1. The rows of the coding matrix represent the transmit antennas while its columns correspond to different time instances.

It is clear that the encoding is done in both the space and time domains. The transmit sequence from antennas one and two by x^1 and x^2 , respectively.

$$x^{t1} = [x_1, -x*_2]$$
$$x^{t2} = [x_2, x*_1]$$

The transmit sequences from the two transmit antennas are orthogonal, and the inner product of the sequences x^1 and x^2 is zero, i.e.

$$x^{t1} . x^{t2} = x_1 x*_2 - x*_2 x_1 \quad (2)$$

Code matrix has the following as:

$$X . X^H = \begin{bmatrix} |x_1|^2 + |x_2|^2 & 0 \\ 0 & |x_1|^2 + |x_2|^2 \end{bmatrix}$$
$$= (|x_1|^2 + |x_2|^2)\, I_2 \quad (3)$$

Where I_2 is a2 X 2 identity matrix

At the receive antenna, the received signals over two consecutive symbol periods, denoted by r_1 and r_2 for time t and $t + T$, respectively, can be expressed as.

$$r_1 = h_1 x_1 + h_2 x_2 + n_1$$
$$r_2 = - h_1 x*_1 + h_2 x*_2 + n_2 \quad (4)$$

WAVELET TRANSFORM

Wavelet domain is advantageous because Discrete Wavelet Transform make the signal energy concentrate in a small number of coefficients, hence, the DWT of a noisy image in consists of number of coefficientshaving high Signal to Noise Ratio(SNR) while relatively large number of coefficients is having low Signal to Noise Ratio. After removing the coefficients with low SNR, the image is reconstructed using inverse DWT. Time and frequency localization is simultaneously provided by Wavelet transform. Moreover, in wavelet methods are represent such signals much more efficiently than either the original domain or fourier transform. The DWT is same as hierarchical sub band techniques where the sub bands are logarithmicallyspaced in frequency and represent octave-band decomposition. Image is decomposed into four sub-bands system and critically sampled by applying DWT as shown in Fig. 1. These sub bands areformed by separable applications of horizontal and vertical filters. Sub-bands with label LH1, HL1 and HH1 correspond to finest scale coefficient while sub-band LL1 represents coarse level coefficients. The LL1 sub band is further decomposed and critically sampled to find outthe next coarse level of wavelet coefficients as shown in Fig. 2. It results in two level waveletdecomposition.

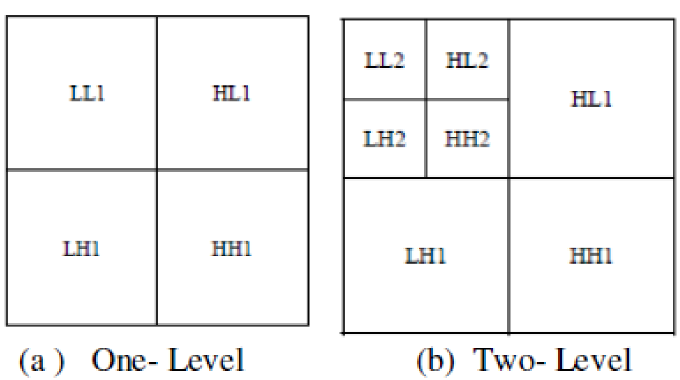

Fig. 1 Image Decomposition by using DWT [3]

Median Filter

Spatial filters employ a low pass filter on groups of pixels with the assumption that the noise occupies the higher region of frequency. Generally spatial filters remove noise to a reasonable extent but at the cost of blurring images which in turn makes the edges in pictures for invisible. With non-linear filters, the noise is removed without any attempts to explicitly identify it like median filter system. Median filter follows the moving window principle, like mean filter. A 3×3, or 5×5, kernel method of pixels is moved over the entire image.

B(1,1)	B(1,2)	B(1,3)
B(2,1)	B(2,2)	

Fig. 2 Processed Neighbors [4]

First the median of the pixel values in the window is computed, and then the center pixel of the window is replaced with the computed median value. The calculation of Median is done as first sorting all the pixel values from the surrounding neighborhood and then replacing the pixel being considered with the middle filter pixel value. Median filter works as shown in "(1)".

$ff(x,y) = median(s,t)\epsilon sxy\{g(s,t)\}$ (5)

Weiner Filter

The linear filters too tend to blur sharp edges, destroy lines and other fine image details, than perform poorly in the presence of signal-dependent noise, like wiener filter. The wiener filter is based on the least-squared principle. the filter minimizes the mean-squared error (MSE) between the actual output and the desired output. The wiener filtering is given by eq. "(6)".

$f\ (x,y) = \bar{g} + \frac{\sigma f2}{f2\sigma} + \sigma ff2 + \sigma\sigma nn2(g(x,y) - \bar{g})$ (6)

Where $\hat{f}(x,y)$ denotes the restored image and $\bar{g}$ is the local mean σ_f^2 is local variance

σ_n^2 is the noise variance

Let us consider $(2m+1) \times (2n+1)$ window size then local mean $\bar{g}$ is defined as in "(7)".

$\bar{g} = \frac{1}{L}\sum_{t=-n}^{n} g(s,t)$ (7)

Where L is total number of pixels in a window .Similarly consider $(2m+1) * (2n+1)$ window then local variance σg^2 is defined as in "(8)".

$\sigma_g^2 = \frac{1}{L-1}\sum_{s=-m}^{m}\sum_{t=-n}^{n}\{ g(s,t) - \bar{g}\}\text{^}2$ (8)

The local signal variance σ_f^2 is used in eq. "(6)" is calculated from σ_g^2 with a priori knowledge of noise variance σ_n^2 simply by subtracting σ_n^2 from σ_g^2 with the assumption that signal and noise are not correlated with each other. The transform domain filtering methods can be subdivided according to the choice of the basic functions. The basic functions can be further classified as data adaptive and non-adaptive.

QUADRATURE AMPLITUDE MODULATION

The Quadrature Amplitude Modulation is popular modulation technique used in various wireless standards communication. It combined with PSK and ASK which has two different signals sent concurrently on the same carrier frequency but one should be shifted by 90º with respect to the other signal.

$s(t) = d_1(t)\cos 2\pi f_c t + d_2(t)\sin 2\pi f_c t$ (9)

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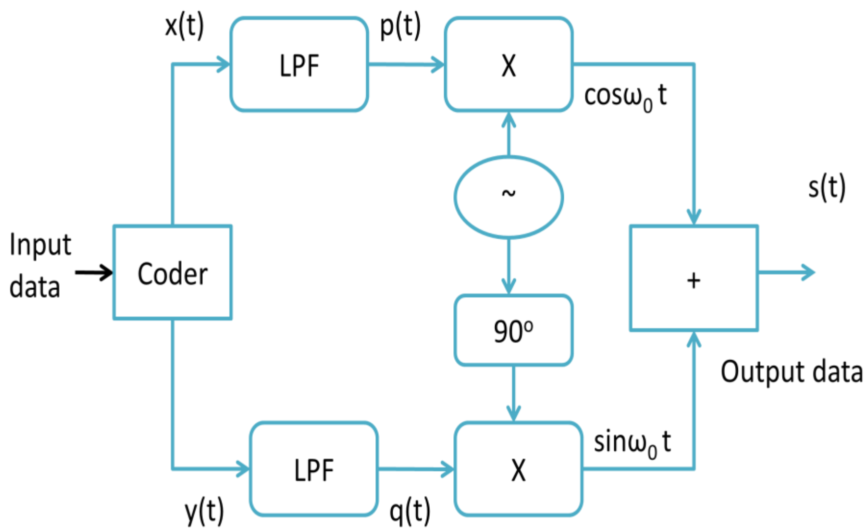

Fig. 3 Quadrature Amplitude Modulation System

RESULTS AND DISCUSSION

The system description for the simulation is given in fig 4. The image data are transmitted through the MIMO WLAN system with FEC code and resiever side using Wavlete transform.

Table 1. Simulation Parameters of MIMO-WLAN

S. No.	Parameter	Value
1	IFFT	64
2	Modulation technique	QAM-8
3	No. of Bit	52
3	No. of Symbol	100
4	Carrier Rate	½

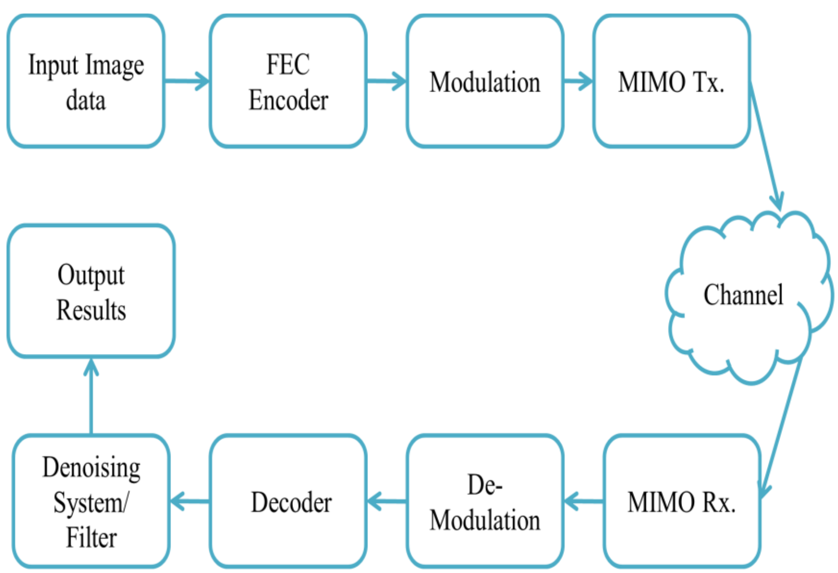

Fig. 4 System block Diagram

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Fig. 5 Original Image

Fig. 6 Used wavlete Median Filter

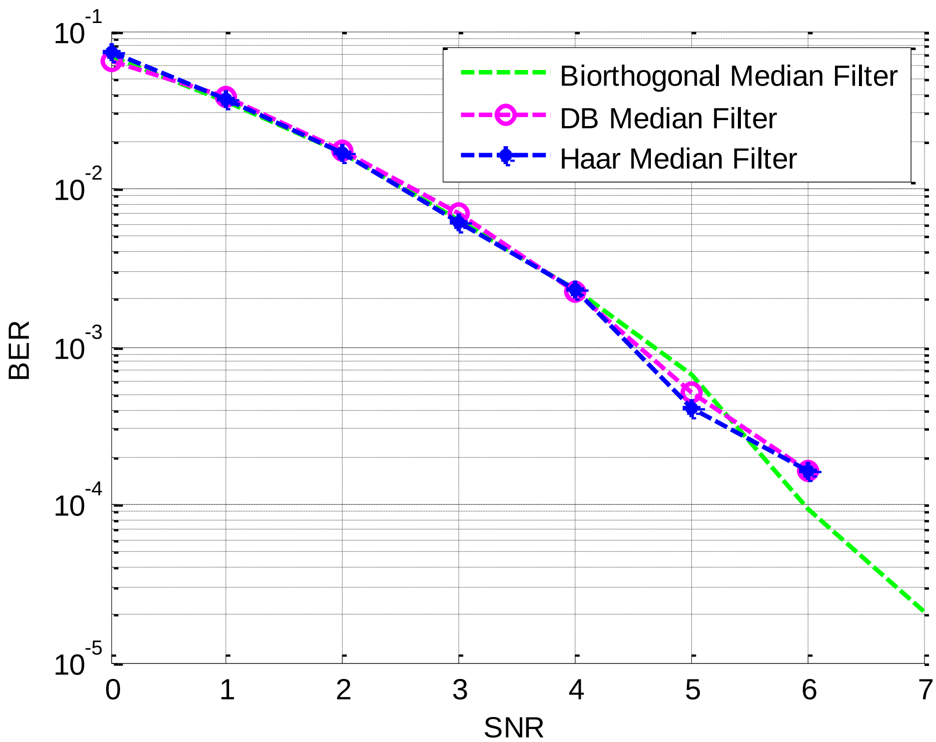

Fig. 7 Performance of MIMO with median filter

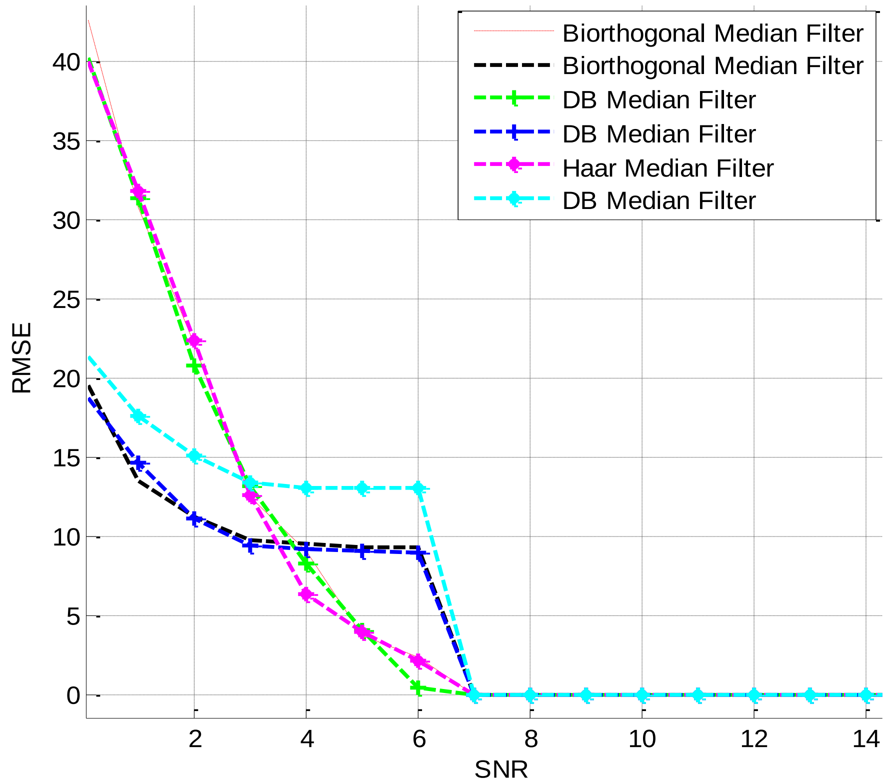

Fig. 8 Performance of MIMO with median filter

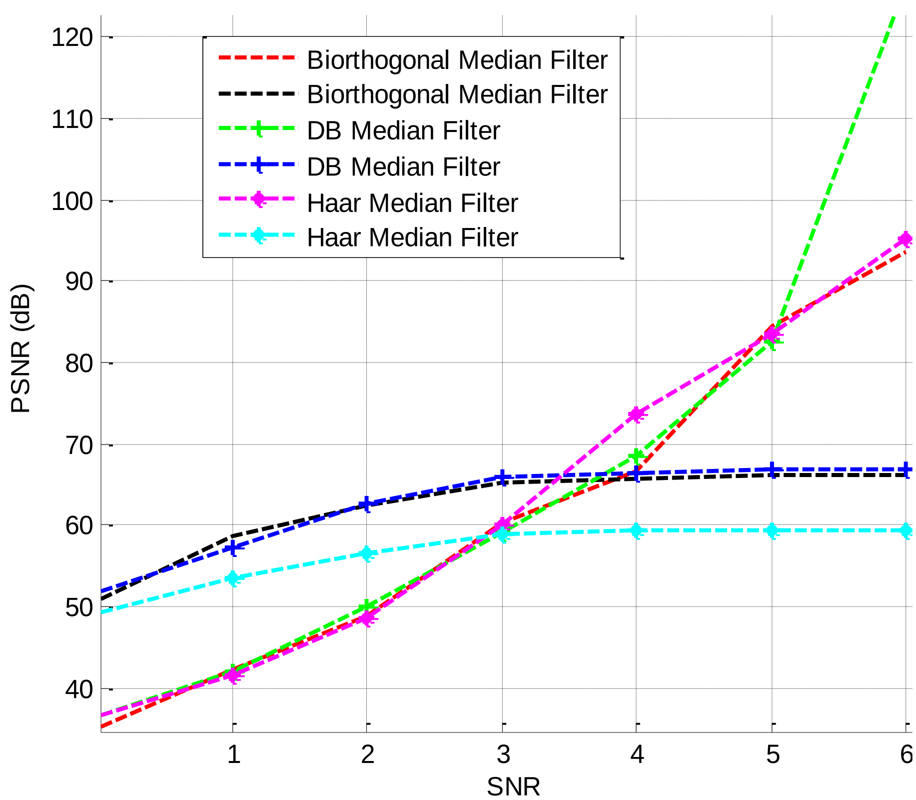

Fig. 9 Performance of MIMO with median filter

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CONCLUSION

The simulation results shows that the use of MIMO with WLAN system gives better performance for image transmission. The simulation results also show that the image can be recovered at the receiver even at very low SNR values. It is found that with increase of modulation order the capacity enhancement but BER are degraded, the can be recovering with the increase in number of receiver antennas.

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