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Wavelet Transform Analysis an Noise Estimation through Image Transmission via DM and Cognitive Radio Channel

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Abstract

Numerous applications are used in communication channels to transmit data (text, image, audio, and video) via the packetization process. Audio and video transmission processes are implemented in FDMA. Only a subset of carriers in an OFDM system may successfully transmit data (images) due to channel fading. The remaining descriptions, which would otherwise have been dropped at the receiver due to unacceptable high channel errors, can be actively decided to be mapped optimally onto the good subcarriers and discarded at the transmitter itself if the channel state information is available at the transmitter. In our project, we describe a method for transmitting compressed image frames based on discrete wavelet processing across OFDM channels while using less energy.The mapped descriptions onto the problematic subchannels are dropped at the transmitter to lower system power consumption. In our project, we're using packetization to successfully transmit data while using less energy by transmitting images over an OFDM channel. In this project, we use several modulations and channel SNR ratios to conduct energy-saving calculations at a maximum level of 16 PSK modulation, which result in a 38% energy savings and a 51% PSNR quality measurement.

Index Terms- Matrix Laboratory (MATLAB), orthogonal frequency division multiplexing (OFDM), Bit Error Rate (BER),

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Phase shift keying (PSK),additive white Gaussian noise (AWGN). Inter-symbol interference (ISI). Frequency Division Multiple Access (FDMA), Peak Signal to Noise Ratio (PSNR

I .INTRODUCTION

Image transmission in an OFDM system has gained interest in recent years. Since images are prone to wide variety of noises in the communication channel, it should be de-noised using filters. A wide variety of filters are available like average filter, Gaussian filter, weighted median filter, weiner filter and so on [3]. However since OFDM systems have high PAPR ratio, have high resistance to frequency selective fading due to the orthogonality of large number of narrow-band sub-carriers. Due to this property the ISI is also greatly reduced [4]. The input file is taken from an image file person.jpg available as a MATLAB image, the image converted to a gray scale image and stored in a bitmap file *persan.bmp.*

The image is converted into symbols the size of each is determined by the type of modulation. The data is the separated into frames and the modulated by the modulator frame by frame. All sub-carriers are realized together using IFFT which is computationally very efficient and also cost effective.[2] The frequency domain representation of the data is converted into time domain using IFFT. The higher the IFFT_ size, the more complex the OFDM system is and a higher data rate is achieved. Cyclic prefix are added along with frame guards in between the modulated frames.

The cascaded frames are then transmitted after converting into analog format using DAC and an RF-front

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end amplifier. The communication channel is modeled using AWGN and amplitude clipping introduced in the channel. Since OFDM signal has a high PAPR they are subjected to amplitude clipping introduced in the channel. At the receiver an RF-front end amplifier amplifies the signal an the DAC converts the analog frames to digital. An envelope detector acts as a frame detector detecting the start and end of the every frame. The frames are converted to serial data and using FFT, they are converted into symbols in the spectral space. The carriers are then extracted and the symbols demodulated and the frames are cascaded and the image reproduced. The simplified block diagram of the OFDM Transmitter is shown in figure 1.

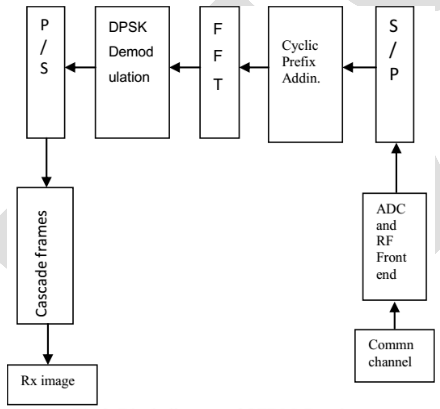


Fig 2. Block diagram of OFDM Receiver

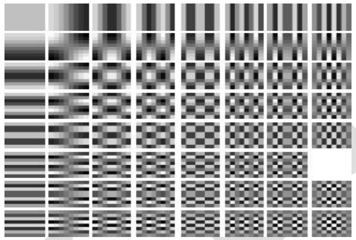
The usage of cyclic prefix and coding techniques help to reduce AWGN[1] to a certain extent, but still its effect is more pronounced in image transmission over noisy channels when SNR≤15 dB.

METHOD: 1

IMAGE COMPRESSION USING THE DISCRETE COSINE TRANSFORM

The discrete cosine transforms (DCT) is a technique for converting a signal into elementary frequency components. It is widely used in image compression. Here we develop some simple functions to compute the DCT and to compress images. These functions illustrate the power of Mathematical in the prototyping of image processing algorithms.

Fig 3: DWT transformed images 2D BLOCED DCT:



To this point, we have defined functions to compute the DCT of a list of length n = 8 and the 2D DCT of an 8 x 8 array. We have restricted our attention to this case partly for simplicity of exposition, and partly because when it is used for image compression, the DCT is typically restricted to this size. Rather than taking the transformation of the image as a whole, the DCT is applied separately to 8 x 8 blocks of the image. We call this a *blocked* DCT.

To compute a blocked DCT, we do not actually have to divide the image into blocks. Since the 2D DCT is separable, we can partition each row into lists of length 8, apply the DCT to them, rejoin the resulting lists, and then transpose the whole image and repeat the process.

When DCT is applied to a row of length 16, the second rule comes into play. The row is partitioned into two lists of length 8, and **DCT** is applied to each. These applications invoke the last rule, which simply computes the 1D DCT of the lists of length 8. The two sub-rows are then rejoined by the second rule. After each row has been transformed in this way, the entire matrix is transposed by the first rule. The process of partitioning, transforming, and rejoining each row is then repeated, and the resulting matrix is transposed again.

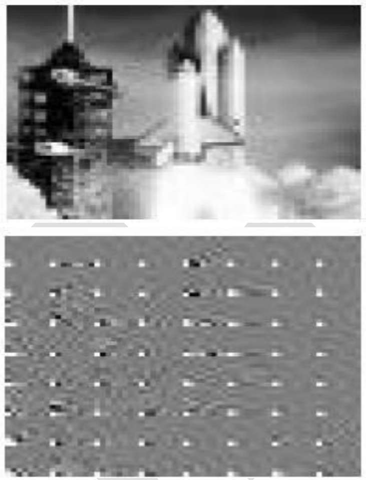


Fig 4: DCT transformed imges QUANTIZATION:

will not implement the entropy coding required to create a compressed image file.

METHOD: 2

EFFICIENT COMPRESSION OF IMAGE BY LIFTING BASED TECHNIQUE

Images contain large amounts of information that requires much storage space, large transmission bandwidths and long transmission times. Therefore it is advantageous to compress the image by storing only the essential information needed to reconstruct the image. Image compression is important for many applications that involve huge data storage, transmission and retrieval such as for multimedia, documents, videoconferencing, and medical imaging. Uncompressed images require considerable storage capacity and transmission bandwidth.The objective of image compression technique is to reduce redundancy of the image data in order to be able to store or transmit data in an efficient form. This results in the reduction of file size and allows more images to be stored in a given amount of disk or memory space

In loss compression, the original signal cannot be exactly reconstructed from the compressed data. The reason is that, much of the detail in an image can be discarded without greatly changing the appearance of the image. As an example consider an image of a tree, which occupies several hundred megabytes. In loss image compression, though very fine details of the images are lost, but image size is drastically reduced. Loss image compressions are useful in applications such as broadcast television, videoconferencing, and facsimile transmission, in which a certain amount of error is an acceptable trade-off for increased compression performance. Methods for loss compression include: Fractal compression, Transform coding, Fourier-related transform, DCT (Discrete Cosine Transform) and Wavelet transform.

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In this research a new and very competent image compression scheme is proposed based on discrete wavelet transform that results less computational complexity with no sacrifice in image quality. The performance of the proposed algorithm has been compared with some other common compression standards. Several quality measurement variables like peak signal to noise ratio (PSNR) and mean square error (MSE) have been estimated to determine how well an image is reproduced with respect to the reference image.

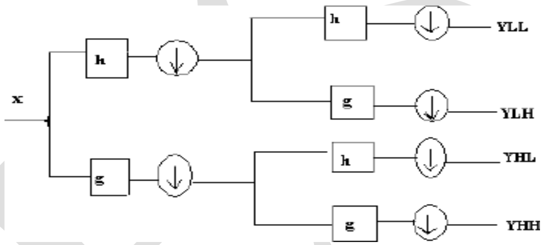
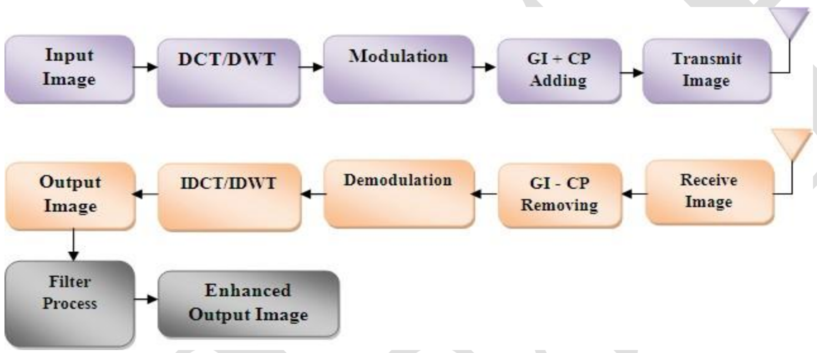


Fig 5: DWT decomposition process

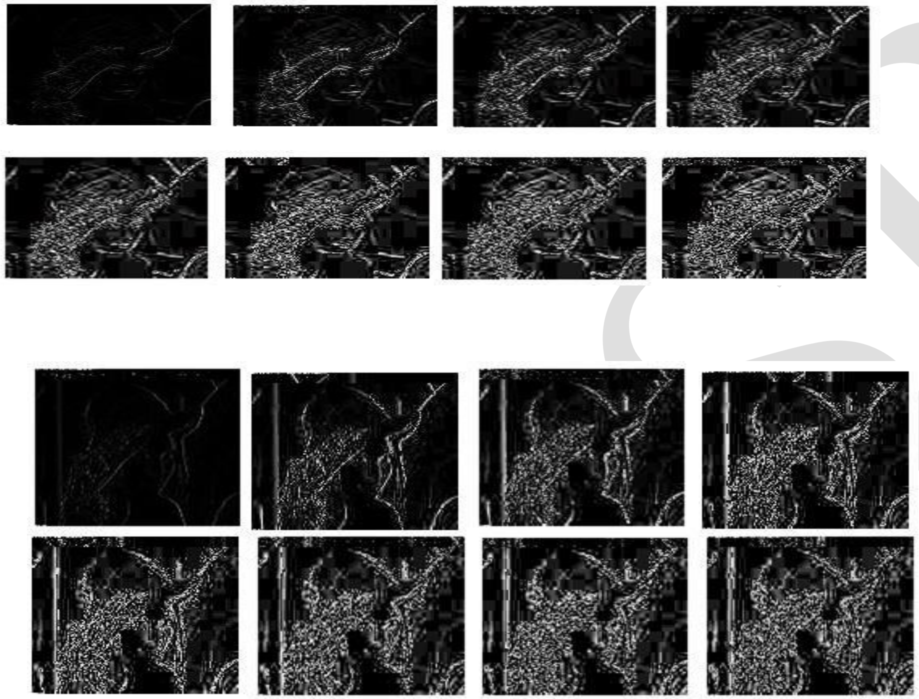
Lifting Based Technique

The lifting scheme is a new method to construct wavelet basis, which was first introduced by Sweden‟s. The lifting scheme entirely relies on the spatial domain, has many advantages compared to filter bank structure, such as lower area, power consumption and computational complexity. The lifting scheme can be easily implemented by hardware due to its significantly reduced computations. Lifting has other advantages, such as "in-place" computation of the DWT; integer-to- integer wavelet transforms which are useful for lossless coding. The lifting scheme has been developed as a flexible tool suitable for constructing the second generation wavelets.

I. IMPLEMENTATION



In our project; we explore the possibility of transmitting JPEG2000 compressed (DWT) image frames through the block fading OFDM channels with binary channel state feedback, where, unlike in conventional layered coded frame transmission, retransmission of lost packets are not allowed.



Depending on the binary channel feedback and a predefined acceptable received power threshold, the„good‟ and „bad‟ (deeply faded) channels are sorted,and the coefficients in Order of their importance levels are mapped to the sub channels belonging to the good ones. As an energy saving measure, if a coefficient is mapped onto a „bad‟ sub channel, we propose that, it is discarded at the transmitter itself. Since our mapping scheme ensures that the discarded coefficients are of rather lesser importance, in most cases the transmitted frame could be reconstructed at the receiver with some distortion, without needing retransmissions. An application scenario of our proposed scheme could be real-time image/video transmission in peer-to-peer broadband communication systems. Prior work on DWT-OFDM system in [5] studied the transmission of DWT compressed still image over OFDM multipath channels. In that approach, the high pass coefficients were simply discarded before transmission. In contrast, in our approach, we consider the possibility of transmitting the low pass as well as high pass coefficients. We also explore the possibility of energy saving in transmission process over fading channel environment by discarding the coefficients of lower importance level through an informed decision process. Note that, as an alternative approach, adaptive modulation and coding (AMC) [6] may prove to be a good solution for the OFDM system with full channel feedback. But it has a higher complexity in terms of optimization, and full channel feedback information is also less reliable in fast-changing environment due channel estimation error. On the contrary, under such fast fading channel conditions, the binary channel state information at the transmitter could be available more reliably and at a much lower overhead. This is because, in our approach, binary feedback corresponds to the comparison of the received signal strength with the threshold without resorting to any channel estimation technique. In our proof of concept study, we generate four coefficients, after the first level DWT. Each coefficient in the form of a data vector is mapped on to a sub channel. We compare the Energy saving and reception quality performance, by sending all coefficients over the mapped sub channels versus discarding the ones that are mapped on to the bad channels. Our results show that, up to 38% energy saving is possible at the low fading margins with a considerably high gain in the quality (PSNR) of the received image.

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II. RESULTS

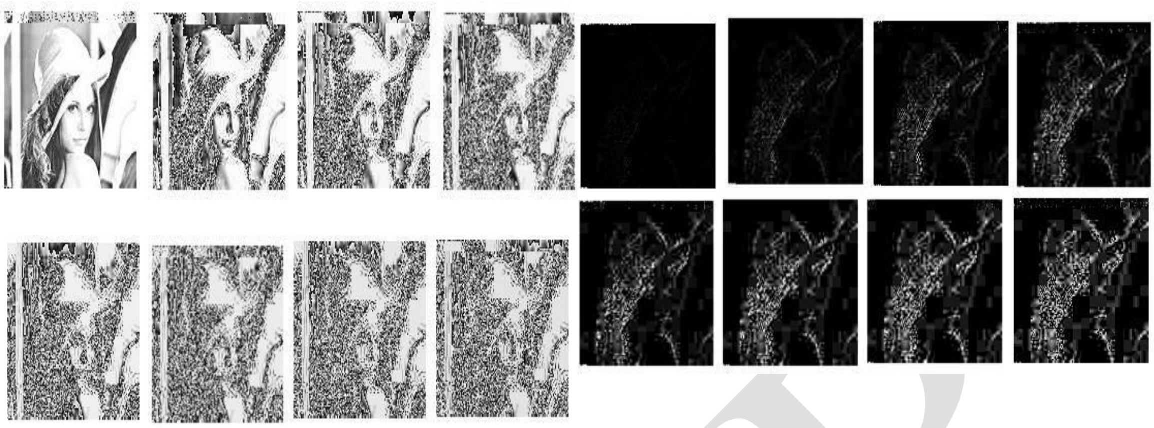


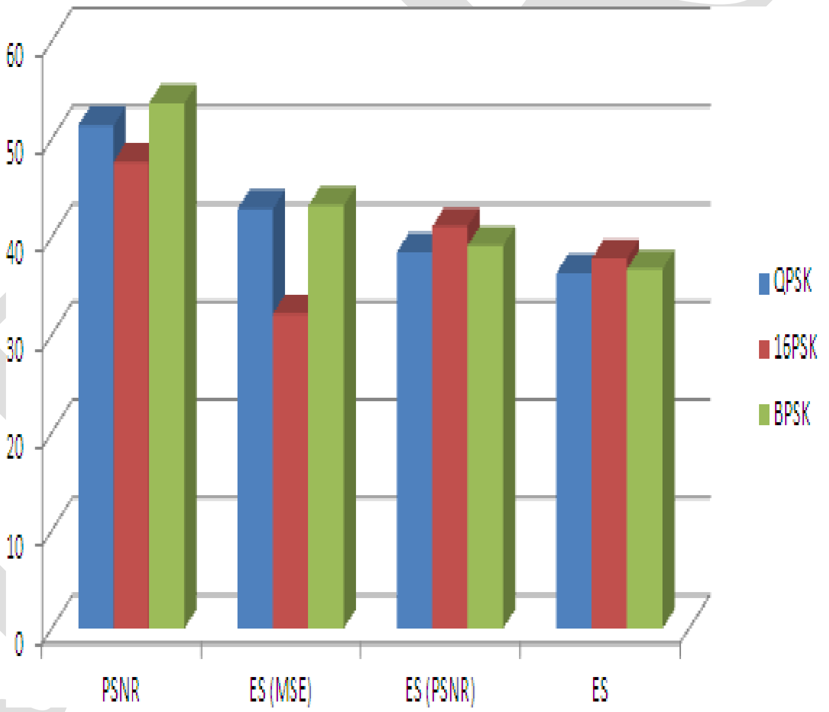
Fig 6 : Image pattern received at the receiver end

Fig 7: SNR at 15dB affected image received at the receiver end

Fig 8: SNR at 15dB affected image received tat the receiver end

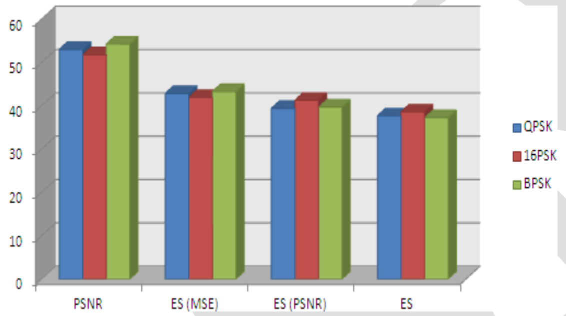
SNR:15db			
	QPSK	16PSK	BPSK
MSE	1.44E+05	3.04E+05	9.19E+04
PSNR	51.4478	47.7084	53.6834
ES (MSE)	42.9101	32.1522	43.2434
ES (PSNR)	38.4902	41.0989	39.165
ES	36.3155	37.818	36.7373

Fig 9: SNR at 15dB comparison on various modulation



SNR:40db			
	QPSK	16PSK	BPSK
MSE	1.05E+05	1.34E+05	8.19E+04
PSNR	53.0019	51.7917	54.2597
ES (MSE)	42.8585	41.9787	43.2909
ES (PSNR)	39.4051	41.2764	39.7198
ES	37.6966	38.6122	37.2762

Fig 10: SNR at 40dB comparison on various modulation



CONCLUSION

To Conclude Our Project Case of DWT Sub band Analysis on 32(8+8+8+8) Packetization on Image Transmission. Over OFDM channels where binary channel state information is available at the transmitter, but retransmission is not allowed. We propose a energy saving approach, where the compressed coefficients are arranged in descending order of priority and mapped over the channels starting with the good ones. In this Project We Implemented Results on Energy saving for 16 PSK and it is Compared to QPSK technique of Previous is better. The coefficients with lower importance level, which are likely mapped over the bad channels, are discarded at the transmitter to save power without significant loss of reception quality. In Our Project we given comparison for BPSK/QPSK/16PSK Modulation on different SNR ratio on 15 and 40db with MSE and PSNR Comparison on MATLAB Simulation]

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