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IMPROVING THE TRANSMISSION OF IMAGE BY USING HUFFMAN ENCODING OVER MIMO OFDM FADING CHANNEL

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ABSTRACT:

In this paper we tend to gift associate energy saving approach to transmission of separate moving ridge transformation primarily based compressed image frames over the OFDM channels. supported channel state data at the Transmitter, the descriptions so as to the method of excellent channels utilized in Huffman and SPHIT encryption. Analysis in analysis of the system in terms of chance of error is disbursed in a very subtle wireless optical channel. As per planned system shows promising results for a high speed optical wireless channel and that we demonstrate the quality of our planned theme in terms of system energy saving while not compromising the received quality in terms of peak signal-noise quantitative relation. Despite victimization a lot of range of carriers rather than set of carriers is usable for made knowledge transmission and allowing the re-transmission of lost packets. Transmitted image and its received versions at totally different PSNRs then it'll improve additionally. The enhancements which will be accomplished in varied performance parameters in a very data communication system victimization moving ridge transformation method. Parameters like power Spectral density and Real, notional elements of the OFDM Signal Verification of BER and SNR comparisons.

Keywords:- OFDM, DWT, HUFFMAN ,SPIHT,SNR.

1. INTRODUCTION

In recent years, the event and demand of transmission product grows progressively quick, conducive to scant information measure of network and storage of device. Therefore, the idea of knowledge compression becomes a lot of and a lot of vital for reducing the info redundancy to save lots of a lot of hardware house and transmission information measure. In engineering science and knowledge theory, knowledge compression or supply writing is that the method of secret writing data mistreatment fewer bits or alternative information-bearing units than Associate in nursing uuencoded illustration. Compression is beneficial as a result of it helps cut back the consumption of costly resources like hard disc house or transmission information measure.

An OFDM primarily based rippling domain diversity combining methodology to combat errors throughout image transmission on wireless channels is developed. For pictures diagrammatical within the rippling domain, diversity is employed to get multiple knowledge streams akin to the transmitted image at the receiver. These individual image knowledge streams area unit combined to make a composite image with higher sensory activity quality.

OFDM-based diversity could be a novel approach that utilizes the sub-carrier orthogonality to send knowledge blocks and mix them at the receiver. Our novel approach of mistreatment OFDM sub-carriers to realize diversity in wireless image transmission is simpler in combating the weakening and alternative channel impairments thanks to its immunity to repose channel reposeference and inter image interference. Not solely this methodology helps in up the received image quality however conjointly offers United States of America the flexibleness in high rate transmission with multiple user access.

The OFDM technique has several benefits in wireless communications and is employed in several sensible systems. OFDM permits digital knowledge to be with efficiency and dependably transmitted in multipath environments by lowering of the image rate leading to lowering of the Inter symbol Interference (ISI). In OFDM scheme; one high-rate bit stream is regenerate to low-rate parallel bit streams. Parallel streams area unit modulated onto orthogonal sub-carriers. Spectrum of those sub-carriers area unit closely spaced and overlapped to realize high information measure potency. The information measure of those sub-carriers becomes tiny compared with the coherence information measure of the channel; i.e. the individual sub-carriers expertise solely flat weakening. So,

OFDM transforms the frequency selective weakening channel into multiple freelance flat weakening sub-channels. Therefore, Associate in Nursing OFDM system can do a high rate and a reliable transmission during a weakening channel. OFDM conjointly uses a cyclic guard time at the beginning of every image to get rid of any Directorate for Inter-Services Intelligence shorter than its length.

IMAGE COMPRESSION:-

Image

Digital image is outlined as a 2 dimensional operate f(x, y), wherever x and y square measure special (plane) coordinates, and therefore the amplitude of f at any try of coordinates (x, y) is termed intensity or gray level of the image at that time. The digital image consists of a finite range of components, every of that includes a specific location and price. {the components the weather} square measure stated as image elements, image components, pels, and pixels. pel is that the term most generally used.

Image Compression

Digital compression addresses the matter of reducing the quantity of knowledge needed to represent a digital image. The underlying basis of the reduction method is removal of redundant information. From the mathematical viewpoint, this amounts to reworking a 2nd pel array into a statically unrelated information set. the info redundancy isn't associate abstract idea however a mathematically quantitative entity. If n1 and n2 denote the amount of info-carrying units in 2 information sets that represent identical information, the relative information redundancy of the primary information set (the one characterized by n1) is outlined as,

$$R_D = 1 - \frac{1}{C_R}$$

Where referred to as as compression quantitative relation [2]. it's outlined as

$$C_R = \frac{n1}{n2}$$

In compression, 3 basic information redundancies is known and exploited: cryptography redundancy lay to rest pel redundancy, and phychovisal redundancy. Compression is achieved once one or a lot of of those redundancies square measure reduced or eliminated.

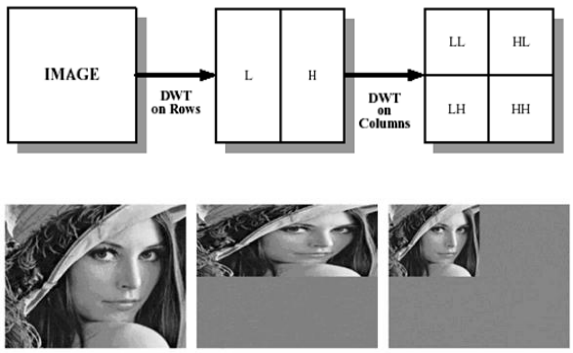
Wavelet Approach

The riffle cryptography techniques are predicated on the concept that the co-efficient of a rework that ornamentation relates the pixels of a picture is coded a lot of with efficiency than the initial pixels themselves. If the transform's basis functions during this case wavelet- packs most of the vital visual info into little range of co-efficient, the remaining co-efficient is coarsely measure or truncated to zero with very little image distortion.

The still image compression, modern DWT based coders have outperformed DCT based coders providing higher compression ratio and more peak signal to noise ratio (PSNR) due to the wavelet transforms multi-resolution and energy compaction properties and the ability to handle signals.

2-D Wavelet Transform

The 1-D DWT can be extended to 2-D transform using separable wavelet filters. With separable filters, applying a 1-D transform to all the rows of the input and then repeating on all of the columns can compute the 2-D transform.



(a) (b) (c)

Block Diagram of DWT (a) Original Image (b) Output image after the 1-D applied on Row input (c) Output image after the second 1-D applied on row input.

When one-level 2-D DWT is applied to an image, four transform coefficient sets are created. As depicted in Figure, the four sets are LL, HL, LH, and HH, where the first letter corresponds to applying either a low pass or high pass filter to the rows, and the second letter refers to the filter applied to the columns.

HUFFMAN Encoding

Huffman encoding works by substituting more efficient codes for data and the codes are then stored as a conversion table and passed to the decoder before the decoding process takes place. Coding redundancy arises when the representation chosen for the pixel values of an image is not the most efficient that is possible.

The value at a pixel in a typical grayscale image relates to the intensity of light detected by the camera that acquired the image. We cannot represent the actual intensity measurements; instead, we quintile the data and represent intensities by a discrete set of what, in the language of information theory, are termed codeword. Image unitization uses a standard binary coding scheme in which the code words are the set of values that can be represented with a fixed number of bits. Furthermore, the code words are ordered in the same way as the intensities that they represent; thus the bit pattern 00000000, corresponding to the value 0, represents the darkest points in an image and the bit pattern 11111111, corresponding to the value 255, representing the brightest points.

An 8-bit coding scheme has the capacity to represent 256 distinct levels of intensity in an image. But if there are only 16 different gray levels in a particular image. Such an image exhibits coding redundancy because it could in theory, be represented using a 4-bit coding scheme. Coding redundancy can also arise due to the use of fixed-length code words.

SPIHT Coding

The SPIHT coder is a powerful image compression algorithm that produces an embedded bit stream from which the best reconstructed images in the mean square error sense can be extracted at various bit rates. The perceptual image quality, however, is not guaranteed to be optimal since the coder is not designed to explicitly consider the human visual system (HVS) characteristics.

Extensive HVS research has shown that there are three perceptually significant activity regions in an image: smooth, edge,

and textured or detailed regions. By incorporating the differing sensitivity of the HVS to these regions in image compression schemes such as SPIHT, the perceptual quality of the images can be improved at all bit rates.

Previous work to improve the visual quality of embedded coders has applied just noticeable distortion thresholds for uniform noise in different sub bands to weight the transform coefficients but no distinction made between coefficients belonging to different activity regions inside a sub band. In this paper, the differing activity regions are used to assign perceptual weights to the transform coefficients prior to SPIHT encoding.

OFDM TRANSMISSION:-

OFDM is a special form of Multi Carrier Modulation (MCM) with densely spaced sub carriers with overlapping spectra, thus allowing for multiple-access. MCM is the principle of transmitting data by dividing the stream into several bit streams, each of which has a much lower bit rate, and by using these sub-streams to modulate several carriers. This technique is being investigated as the next generation transmission scheme for mobile wireless communications networks.

Orthogonality:

In geometry, orthogonal means, "involving right angles" (from Greek ortho, meaning right, and gon meaning angled). The term has been extended to general use, meaning the characteristic of being independent (relative to something else). It also can mean: non-redundant, non-overlapping, or irrelevant. Orthogonality is defined for both real and complex valued functions. The functions $\varphi_m(t)$ and $\varphi_n(t)$ are said to be orthogonal with respect to each other over the interval $a < t < b$ if they satisfy the condition:

$$\int_a^b \varphi_m(t)\,\varphi_m^*(t)\,dt = 0, \text{ Where } n \neq m,$$

As fore mentioned, OFDM is a special form of MCM and the OFDM time domain waveforms are chosen such that mutual orthogonality is ensured even though sub-carrier spectra may over-lap. With respect to OFDM, it can be stated that orthogonality is an implication of a definite and fixed relationship between all carriers in the collection. It means that each carrier is positioned such that it occurs at the zero energy frequency point of all other carriers.

Orthogonal Frequency Division Multiplexing (OFDM) is a multicarrier transmission technique, which divides the available spectrum into many carriers, each one being modulated by a low rate data stream. OFDM is similar to FDMA in that the multiple user access is achieved by subdividing the available bandwidth into multiple channels that are then allocated to users. However, OFDM uses the spectrum much more efficiently by spacing the channels much closer together. This is

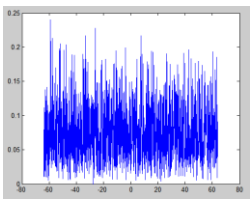
achieved by making all the carriers orthogonal to one another, preventing interference between the closely spaced carriers.

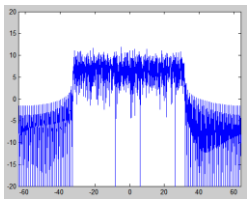
Coded Orthogonal Frequency Division Multiplexing (COFDM) is the same as OFDM except that forward error correction is applied to the signal before transmission.

OFDM generation:

To generate OFDM successfully the relationship between all the carriers must be carefully controlled to maintain the orthogonality of the carriers. For this reason, OFDM is generated by firstly choosing the spectrum required, based on the input data, and modulation scheme used. Each carrier to be produced is assigned some data to transmit. The required amplitude and phase of the carrier is then calculated based on the modulation scheme (typically differential BPSK, QPSK, or QAM).

The required spectrum is then converted back to its time domain signal using an Inverse Fourier Transform. In most applications, an Inverse Fast Fourier Transform (IFFT) is used. The IFFT performs the transformation very efficiently, and provides a simple way of ensuring the carrier signals produced are orthogonal.





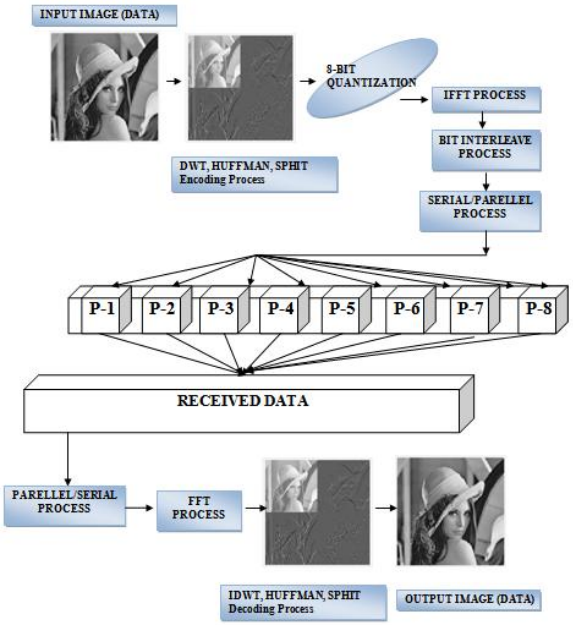
The Fast Fourier Transform (FFT) transforms a cyclic time domain signal into its equivalent frequency spectrum. This is done by finding the equivalent waveform, generated by a sum of orthogonal sinusoidal components. The amplitude and phase of the sinusoidal components represent the frequency spectrum of the time domain signal. The IFFT performs the reverse process, transforming a spectrum (amplitude and phase of each component) into a time domain signal.

An IFFT converts a number of complex data points, of length, which is a power of 2, into the time domain signal of the same number of points. Each data point in frequency spectrum used for an FFT or IFFT is called a bin. The orthogonal carriers required for the OFDM signal can be easily generated by setting the amplitude and phase of each bin, then performing the IFFT. Since each bin of an IFFT corresponds to the amplitude and phase of a set of orthogonal sinusoids, the reverse process guarantees that the carriers generated are orthogonal.

QUADRATURE AMPLITUDE MODULATION (QAM)

Quadrature amplitude modulation (QAM) is both an analog and a digital modulation scheme. It conveys two analog message signals, or two digital bit streams, by changing (modulating) the amplitudes of two carrier waves, using the amplitude-shift keying (ASK) digital modulation scheme or amplitude modulation (AM) analog modulation scheme. The two carrier waves, usually sinusoids, are out of phase with each

other by 90° and are thus called quadrature carriers or quadrature components, hence the name of the scheme.



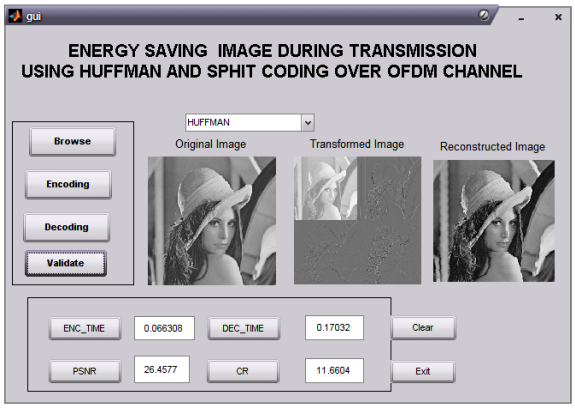
The modulated waves are summed, and the resulting waveform is a combination of both phase-shift keying (PSK) and amplitude-shift keying (ASK), or (in the analog case) of phase modulation (PM) and amplitude modulation. In the digital QAM case, a finite number of at least two phases and at least two amplitudes are used. PSK modulators are often designed using the QAM principle, but are not considered as QAM since the amplitude of the modulated carrier signal is constant. QAM is used extensively as a modulation scheme for digital telecommunication systems. Spectral efficiencies of 6 bits/s/Hz can be achieved with QAM.

AWGN (Additive white Gaussian noise):-

The effect of fading we have neglected here the AWGN in simulation as well as in analysis, it can be concluded that the distortion in reception process increases with power threshold PTH. But this increase is not high, as the data having lower importance have a higher probability of transmission through the bad sub-channel. It follows from the figure that the energy saving is also increasing by restricting lesser important data from transmission through bad sub-channels.

RESULT ANALYSIS:-

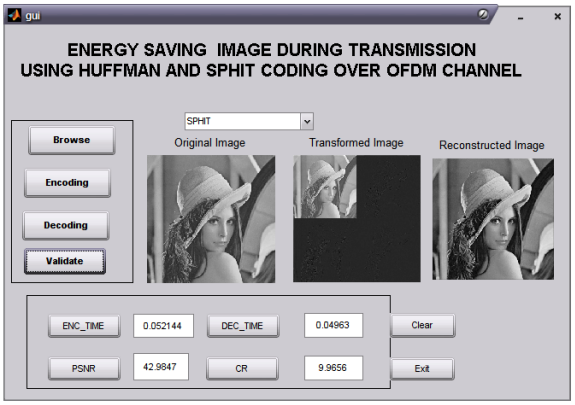
From the experimental results, we can see that values of *L* are less than 3, so we can achieve the compression effect.



For each image in the same rate always the probability of each symbol appear flat, and only small fluctuations, so saving the number of bits are also pretty much the same thing. With the rate increase word code length in average(*L*) will be an increasing trend, but after the rate greater than 0.3bpp the trending will be become very slow , and more value of rate more bits will be save.

MEAN SQUARE ERROR

The MSE is the second moment (about the origin) of the error, and thus incorporates both the variance of the estimator and its bias. For an unbiased estimator, the MSE is the variance of the estimator.

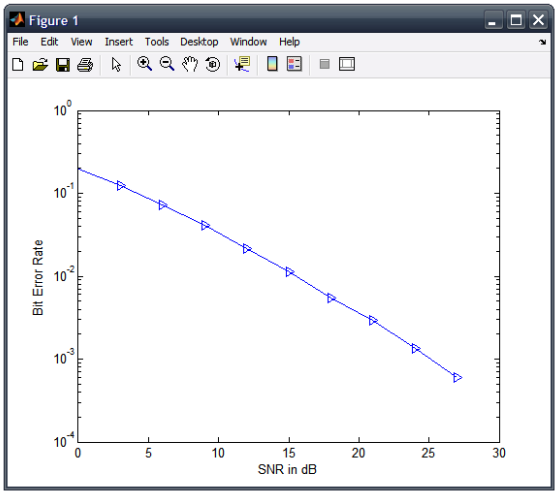


Like the variance, MSE has the same units of measurement as the square of the quantity being estimated.

BIT ERROR RATE

In digital transmission, the number of bit errors is the number of received bits of a data stream over a communication channel that have been altered due to noise, interference, distortion or bit synchronization errors.

The bit error rate or bit error ratio (BER) is the number of bit errors divided by the total number of transferred bits during a studied time interval.



BER is a unit less performance measure, often expressed as a percentage.

	MSE value	**PSNR value**
DWT	192.5	21db
HUFFMAN	148.15	26db
SPIHT	3.30	42db

In an analogy to standard deviation, taking the square root of MSE yields the root mean square error or root mean square deviation (RMSE or RMSD), which has the same units as the quantity being estimated; for an unbiased estimator, the RMSE is the square root of the variance, known as the standard deviation.

CONCLUSION:-

Proposing an easy and effective technique combined with Huffman coding for additional compression during this paper that saves plenty of Log bits within the image information transmission. There's terribly big selection of sensible price for these days that contains a sizable

amount of image data's to be transmitted. We have a tendency to propose a energy saving approach, wherever the compressed coefficients ar organized in down order of priority and mapped over the channels beginning with the great ones. The coefficients with lower importance level, that ar probably mapped over the dangerous channels, ar discarded at the transmitter to avoid wasting power while not vital loss of reception quality. Our analytic observations on reception quality and energy saving performance ar valid by intensive MATLAB simulations.

SCOPE OF the longer term WORK

In the future, this work will more be optimized to hold out all the phases on Verilog HDL. The Verilog HDL code is often optimized to attain the required leads to lesser time and fewer storage parts. Also, the newer FPGA families being introduced within the market provide higher performance and additional storage parts to reinforce performance and yield higher results.

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