International Journal for Modern Trends in Science and Technology
Volume: 03, Issue No: 04, April 2017
ISSN: 2455-3778
http://www.ijmtst.com

A Novel Coding Scheme for Data Quality Enhancement over Wireless Channels

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To Cite this Article
Mutyam V V Satyanarayana Murthy, Pulamanthula Vasavi Yesu Sai Durga, Kavya Deepthi Bethala, Pericharla Ramana Kumar Varma and K N V Suresh Varma, "A Novel Coding Scheme for Data Quality Enhancement over Wireless Channels", *International Journal for Modern Trends in Science and Technology*, Vol. 03, Issue 04, 2017, pp. 119-123.

ABSTRACT

The present solution gives an optimum algorithm for effective transfer of image codings over a wireless medium. In this paper, the logic behind generating Huffman codes for the gray symbols of an image, its transmission over an AWGN channel and decoding the received code is practically analysed. The coding utilizes a main MATLAB file with associated function to carry out subsequent tasks. The solution carries reduced delay and improved image and Text quality based on different SNR values.

KEYWORDS: *Huffman Code; AWGN Channel; MATLAB; QAM*

I. INTRODUCTION

Real-time image and video communication is becoming common in the 3 rd generation (3G) wireless systems with the introduction of high data rates. These sources are very sensitive to channel errors and even a small number of channel errors have the potential to introduce significant amounts of perceptual distortion in the reconstructed source. There are many different methods of protecting these sources against channel errors. Channel coding (also known as error protection) and an increase in the transmit power are amongst the most commonly used methods for protecting the transmitted data against channel errors. However, in practical systems, there is always a constraint on available resource, especially bandwidth, data-rate and transmit power. Due to this reason, the use of these resources should be optimized with the goal of minimizing distortion in the reconstructed images and videos. A common way of optimizing the use available bandwidth/data-rate is to perform joint optimization of source coding and channel coding, also known as joint source-channel coding (JSCC) [1–10]. Similarly, joint optimization of source coding and transmit power can also be performed in order to minimize the distortion in the reconstructed data with a constraint on total transmit power. Two such schemes for transmission power management for digital video transmission and vector quantized image transmission are discussed in [11] and [12], respectively. In this paper, we present a scheme for optimizing the use of total available power for transmission of JPEG compressed images over noisy/fading channels, with the goal of minimizing the distortion. We use the distortion models for DC and AC layers in JPEG compressed images derived in [13] to allocate the total available power unequally between different coefficient layers in JPEG compressed images, in order to minimize the distortion, when transmitted over Rayleigh fading channels.

II. Over View of the Paper

In Section 3 we outline our system model. In Section 4 we present our Huffman based QAM unequal power allocation scheme for images, and present our simulation details and results along with some discussion in Section 5. We conclude the paper in Section 6.

III. System Model

Wireless channel characteristics like fading, Inter Symbol Interference (ISI) prohibit the reliable transmission of uncompressed image. As there are constraints on bandwidth, power etc, there is always trade-off between source coding and channel coding. Shanon has given separate source channel coding transmission system [1]. Using Joint Source Channel Coding (JSCC) recent wireless communication technology lead to robust and reliable image transmission [2] [3].The basic block diagram consists of source encoder/decoder and channel encoder/decoder as shown in Figure 1. Source encoder is used to reduce the amount of data necessary to represent the information of the Image signal. The objective of the channel encoder is to add redundancy to the output of the source encoder to enhance the reliability on the transmission.

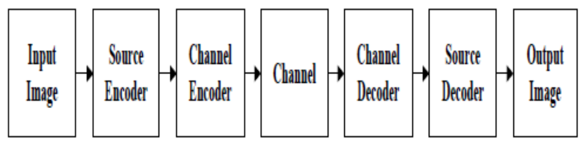

Fig 1: Image Transmission System

Due to wireless channel characteristics, Variable length coding at encoding stage received image quality degrades. So to combat channel errors bit stream has applied protection using different channel code. This is Huff QAM (HQAM) algorithm. But as in multimedia signal like image, audio, video whole bit stream importance in received signal is not same. So Bit stream is partitioned and protection assigned according to importance. This concept defines Unequal Error Protection (UEP). The various image coding algorithms with UEP transmission is mentioned in [4][5][6][7]. In this paper HQAM algorithm implemented and their simulation results are implemented

3.1. Digital Modulation Techniques

We begin our discussion on the digital modulation by starting with the several types of modulation techniques used. All modulation techniques change from a sinusoidal parameter to describe the data information that we have desire to transmit. A sinusoidal signal has three distinct parties which can be varied [7]. These are the amplitude, phase and frequency.

3.2 Quadrature Amplitude Modulation

In the QAM signal, in which the two carriers offset are in phase with 90 degrees, are modulated and the output results have consists together phase and amplitude variations. Because both phase and amplitude variations are introduce, it has also involved as a combination of both phase and amplitude modulation. The digital formats of Quadrature Amplitude Modulation are frequently denoted to as "quantified QAM" and that they are used more and more for the communication of data in radio communications systems.

IV. HUFFMAN based QAM

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. 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.

4.1 Proposed Method

This is the technique of modulation, it is most popular and used in various standards of wireless connection. It combined with install and PSK which has two different signals sent simultaneously on the same carrier frequency but it must be shifted from 90° to the respect of the other signal. At the end of the receiver, the signals are demodulated and the results are combined to obtain the binary input transmitted [8]. The principle equation is:

$$S(t) = d_1(t)\cos(2\pi f_c t) + d_2(t)\cos(2\pi f_c t)$$

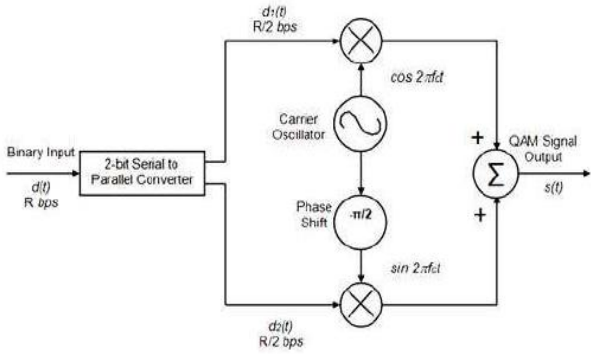

Fig. 2: QAM Modulator Diagram

This is identical to the 16-QAM except that it has 64 States where each symbol represents 6 bits (2^6= 64). It is one Of the techniques of complex modulation but with greater efficiency [16]. The total bandwidth increases as a function of the increase in the number of states for each symbol.

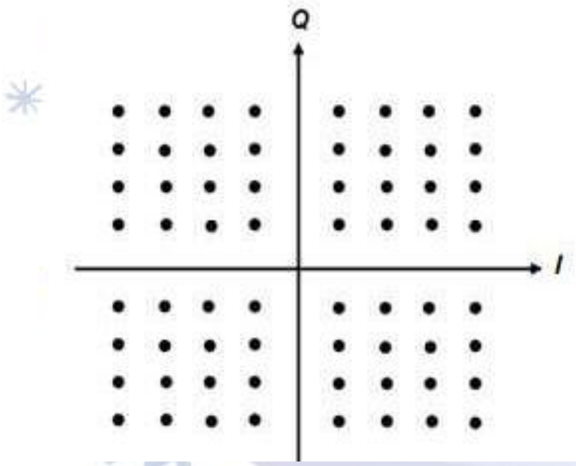

Fig. 3:QAM Constellation Diagram

V. SIMULATION RESULTS

Fig 4: Image over very noisy channel with SNR=5db

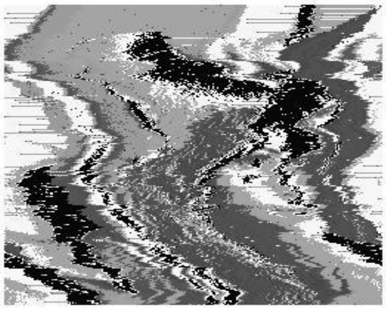

Fig 5: Image over very noisy channel with SNR=10db

Fig 6: Image over very noisy channel with SNR=15db

From the figure 4, figure 5, figure 6 if we transmit image over the noisy channels the quality decrease and delay increases but our proposed method HQAM, both the problems i.e image feature enhancement increases and delay reduces from sec to few micro sec

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Fig 7:Text over very noisy channel with SNR=5db

Mr. Sherlock Holmes, who was usuallfseat.u late in the morn ohitad deupon those not infrequent occasions when he was up all night, was seatedat the breakfast table. I stood usib the hearth-rug and p wtied up thchstick which our visitor had left behind him the hight before. It was afine, thick piece of wood, bulbous-headed, of the sort which is khown asa "Penang lawyer." Just under the head was a broad silver band nearlqhan inch across. "To James Mortimer, M.R.C.S., from his fr hos of theC.C.H.," was engraved upoi it, with the date "1884." It was just such astick as the old-fashioned family practitioner used to carry--dignified,solid, and reassuringkn HC

Fig 8:Text over very noisy channel with SNR=10db

Mr. Sherlock Holmes, who was usually very late in the mornings, saveupon those not infrequent occasions when he was up all night, was seatedat the breakfast table. I stood upon the hearth-rug and picked up thestick which our visitor had left behind him the night before. It was afine, thick piece of wood, bulbous-headed, of the sort which is known asa "Penang lawyer." Just under the head was a broad silver band nearlyan inch across. "To James Mortimer, M.R.C.S., from his friends of theC.C.H.," was engraved upon it, with the date "1884." It was just such astick as the old-fashioned family practitioner used to carry--dignified,solid, and reassuring.

Fig 9:Text over very noisy channel with SNR=15db

From the figure 7, figure 8, figure 9 if we transmit Text over the noisy channels the date misinterpretation takes place and delay increases but our proposed method HQAM, both the problems i.e Text enhancement increases and delay reduces from sec to few micro sec

VI. CONCLUSIONS

The image transmission over communication system using digital modulation techniques are performed and the results are obtained through a high level technical language called MATLAB was introduce for designing and implementing wireless digital communication system. Like many of the other wireless digital communication systems, the performance of this system is acceptable that, up to a certain level of noise from the critical channel. In other words, if the noise level is raised above this critical level, the performance of the system cannot very rapidly. The advantage of the currently designed Huffman based QAM(HQAM) , when the channel is under a condition of high noise, the system generates a quality of image worse rather than completely lose the transmitted image. The simulation results are performed, when SNR value is 5dB,10 dB,15dB. By using 16-QAM modulation technique, which carries higher data rates, this is essential for image and Text transmission. Modulation techniques such as 16-QAM provide better results than the other modulation techniques such as QPSK and ASK.

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