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PERFORMANCE OPTIMIZATION OF OFDM COMMUNICATION SYSTEMS USING ARTIFICIAL NEURAL NETWORKS

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ABSTRACT

With a specific end goal to battle blurring in an OFDM interchanges framework, versatile adjustment systems have been utilized which can enhance the execution. We recommend that a simulated neural system (ANN) can be embedded in an OFDM framework that would give the data important to play out a versatile balance of the subcarriers. The execution of the framework is assessed as far as image mistake likelihood. The consequences of our reenactments enable us to approve our theory. Multicarrier signals are known to experience the ill effects of a high top to-normal power proportion, caused by the expansion of countless balanced subcarriers in parallel at the transmitter. At the point when subjected to a pinnacle restricting channel, for example, a nonlinear power speaker, these signs may experience critical phantom mutilation, prompting both in-band and out-of-band obstruction, and a related corruption in framework execution [1], [2]. This paper portrays the bending caused by the cut-out of multicarrier motions in a pinnacle restricting (nonlinear) channel. Instead of demonstrating the impacts of twisting as added substance clamor, as is across the board in the writing, we recognize cutting as an uncommon occasion and spotlight on assessing framework execution in light of the contingent likelihood of bit blunder given the event of such an occasion [4]. Our examination is Based on the asymptotic properties of the huge journeys of a stationary Gaussian process, and offers critical bits of knowledge into both the genuine idea of cut-out bending, and in addition the resulting outline of plans to reduce this problem[10], [11].

Keywords: Clipping, OFDM, peak-to-average ratio, 802.11a WLAN network, ANN network.

I. INTRODUCTION

As of late, Orthogonal Frequency Division Multiplexing (OFDM) has been received in numerous correspondence benchmarks including broadband ADSL modems, computerized video broadcasting (DVB), and advanced sound telecom (DAB) for computerized radio. When all is said in done OFDM can be made insusceptible to multipath blurring by utilizing a recurrence area one-tap equalizer if the postponement of the longest multipath is not as much as the monitor interim (Tg). The motivation behind this equalizer is to amend the sufficiency and the period of each sub-transporter of OFDM motion by essentially increasing the OFDM range by the estimation of the channel drive reaction at the subcarrier recurrence [1]. It can be demonstrated that on account of differential PSK coding, for example, DQPSK utilized as a part of DAB, the requirement for the one tap equalizer is additionally dispensed with in light of the fact that the channel drive reaction for a specific sub-bearer is relatively consistent for continuous OFDM images gave that the blurring is moderate (i.e. Doppler spread is little contrasted and the sub-bearer dispersing). Be that as it may, communicate DAB motions in the UK have been seen to have multipath postpones that surpass the watch interim bringing about noteworthy execution debasement because of both between image (ISI) and between subcarrier impedance (ISCI). For example, in DAB transmission mode I, signals got from transmitters that are more distant than 74 km cause postpones longer than Tg (= 246 μs) at the recipient. The execution of OFDM frameworks within the sight of stage clamor has been dissected in a few works [3] – [7].

II. BLOCK DIAGRAM OF OFDM USING ANN

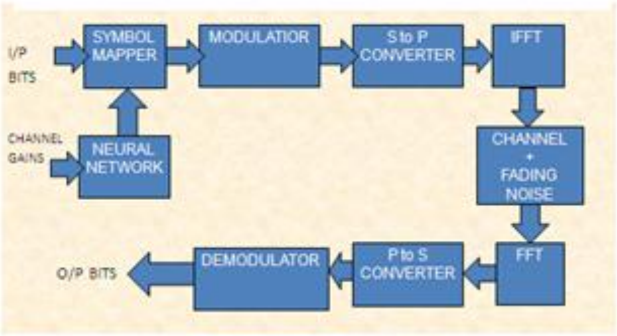

Fig. 1 – Schematic of OFDM using ANN

III. METHODS OF OPTIMIZATION

Neural networks are dynamic systems of a large number of connected data sensing units and simple processing units known as preceptors and neurons respectively (see Figure 1). Each neuron of this network can be considered as an operator, receiving real numbers as input and transforming them into one output value. The output is transmitted by links to connect the neurons. On each link a real number, the weight, is defined. Before an output value is transmitted, it is multiplied by the corresponding weight. Thus the weight reflects the strength of the individual connections see (figure 1) [7]. Modifying the weight values by repeated application of learning rules allows the network to approximate the mapping function, which maps the input space (domain) into the desired output space (range).

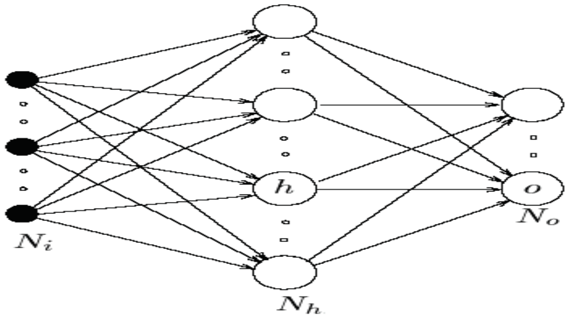

Fig. 2 - Multilayer feed forward NN.

IV. OVERVIEW OF 802.11x WLAN

The OFDM system used in IEEE 802.11a provides a WLAN with data payload communication capabilities of 6, 9, 12, 18, 24, 36, 48, and 54 Mbps. The block diagram of 802.11a system is shown in figure 2.4.1. The system uses 52 sub carriers that are modulated using binary or quadrature phase shift keying (BPSK/QPSK), 16-quadrature amplitude modulation (QAM), or 64-QAM. Forward error correction coding (Convolution coding) is used with a coding rate of 1/2, 2/3, or 3/4. At the transmitter, binary input data is encoded by the industry standard rate 1/2, constraint length 7, code with generator polynomials (133,171). The rate may be increased to 2/3 or 3/4 by puncturing the coded output bits. After interleaving, bits are mapped into complex numbers according to the modulation scheme that is being used. In order to facilitate coherent reception, four pilot values are added to each of the 48 data values, such that a total of 52 modulation values are reached per OFDM symbol. 52 values are then modulated onto 52 sub carriers by applying and Inverse Fast Fourier Transform (IFFT). A guard interval (cyclic prefix) is added to make the system robust to multipath propagation. Next, windowing is applied to attain a narrower output spectrum. The modulated and windowed digital output signals are converted to analog signals, which are then up converted to the proper channel in the 5 GHz band, amplified, and transmitted through an antenna. A typical OFDM receiver basically performs the reverse operations of the transmitter, together with additional training tasks. First, the receiver has to estimate frequency offset and symbol timing, using special training symbols in the preamble. Then, it can do a Fast Fourier Transform (FFT) for every OFDM symbol to recover 52 modulation estimations of all subcarriers. The preparation images and pilot subcarriers are utilized to remedy for the channel reaction and additionally any residual stage float. Subsequent to taking FFT, a Viterbi decoder can be utilized to interpret the data succession with a follow back way of 34. A low many-sided quality delicate choice Viterbi decoder for a bit-interleaved framework can be effectively executed. The introduction is made out of 10 redundancies of a "short preparing" succession, and two reiterations of a "long preparing arrangement". At the collector end, short preparing arrangements are utilized for Automatic Gain Control (AGC) merging, assorted variety choice, timing procurement, and coarse recurrence obtaining in the recipient. Long preparing groupings are utilized for channel estimation and recurrence securing.

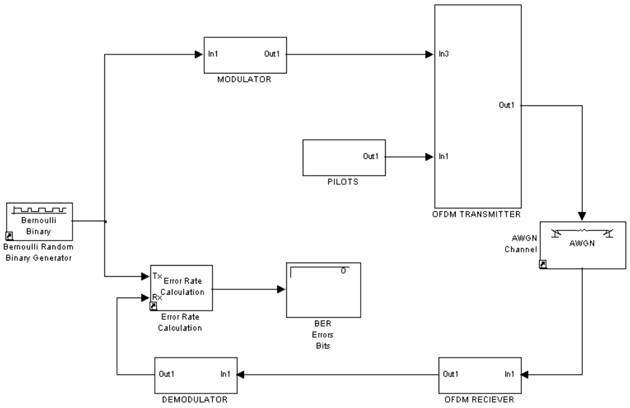

Fig.3 Block diagram of Implemented 802.11a WLAN

V. IEEE 802.11 PHY LAYRES

A fourth 802.11 PHY is defined by IEEE's 802.11a standards: The Coded Orthogonal Frequency Division Multiplexing (COFDM) layer is capable of transmitting data at 54 Mbps by using the broader 5-GHz band. However, FCC regulations limit the transmission power used at these higher frequencies, and thus it reduces the distance higher-frequency transmissions can travel. For these reasons, radios that use COFDM technology must be closer together than those using the other PHY introduced above. The obvious benefit of COFDM is speed. • The sixth 802.11 PHY is detailed in the IEEE 802.11g standards and is backward compatible with 802.11b. The Orthogonal Frequency Division Multiplexing (OFDM) PHY allows 54 Mbps data rates in the 2.4-MHz band. The speed of transmission under OFDM and COFDM is sufficient to carry voice and image data fast enough for most users.

Table 1- List of IEEE 802.11 PHY Layer

Sr. No.	Schemes	Band	Speed
1.	DSSS	2.4 GHz	1 or 2 Mbps
2.	FHSS	2.4 GHz	1 or 2 Mbps
3.	DFIR	850 to 950 nm (infrared)	None implemented
4.	COFDM	5 GHz	54 Mbps
5.	HR/DSSS	2.4 GHz	5.5 or 11 Mbps
6.	OFDM	2.4 GHz	54 Mbps

VI. EXPERIMENTAL STUDY

This simulation is done with Mat lab and Simulink as the tool. The simulation model is designed for AWGN channel with different modulation technique such as BPSK, QPSK 16 QAM, and 64 QAM using ½ and 3/4 code rate. Table1 - List of IEEE 802.11 PHY Layer 802.11a standard, which we used for simulation. The 64 QAM scheme is simulated for 2/3 code rate instead of ½ code rate.

VII. STEPS OF SIMULATION

1. Planned eight reenactment models for AWGN channel conditions, four for ½ code rate and four for ¾ code rate of every one of the four adjustment conspire. Reproduced these whole eight recreation display utilizing MATLAB programming code and assessed the execution utilizing BER Vs SNR plot.
2. Reenacted two recreation models for various code rate of every adjustment conspire for same channel conditions utilizing programming and assessed the execution utilizing BER Vs SNR plot.

VIII. CONCLUSION

In this paper, we have analyzed the execution of the OFDM based IEEE 802.11a WLAN under AWGN blurring channel condition with various regulation plan (BPSK, QPSK, 16 QAM, 64 QAM) and code rate (1/2, 2/3, 3/4). While transmitting the flag in pragmatic blurring ecological condition, multipath blurring impacts happens which causes the bury image obstruction. The impact of intersymbol obstruction can be decreased by utilizing Guard interim and framework execution can be enhanced. However from the execution, it infers that BPSK execution is better as thought about than different plans in boisterous channel. The fair postpone spread matches the season of the cyclic expansion of the protect period, the BER rises quickly due to the entomb image obstruction. From the got trial and reproduction comes about, one can see that the outside multipath attributes at 5.2 GHz with moving units can't be viewed as consistent over the one OFDM outline and thusly, refreshing the channel gauges toward the start of each edge, as at present suggested by the IEEE 802.11a standard, isn't sufficient to precisely repay multipath impacts.

IX. RESULTS & DISCUSSION

1. AWGN Channel for 1/2 Code Rate

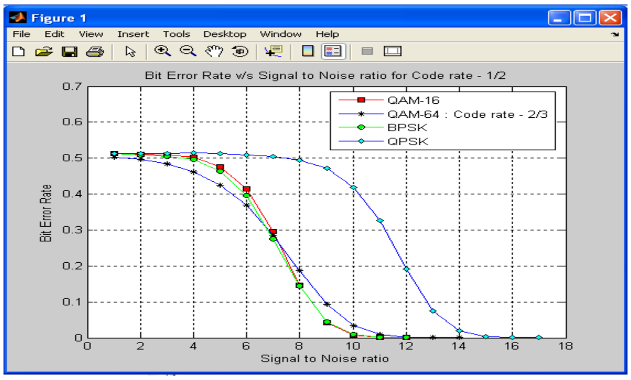

Fig.4– BER Vs SNR plot for ½ code rate

2. AWGN Channel for 3/4 Code Rate

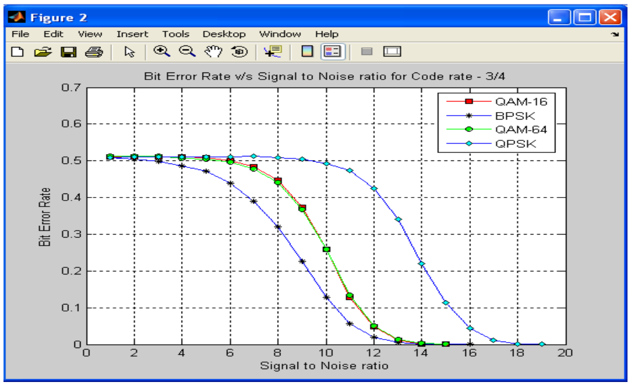

Fig.5 – BER Vs SNR plot for 3/4 code rate

By reenactment utilizing AWGN Channel for ½ and ¾ code rate , it is discovered that the execution of BPSK tweak conspire is superior to anything other adjustment plan, for example, QPSK, 16QAM and 64QAM according to the BER Vs SNR plot got appeared in figure 4 By contrasting the outcome and two diverse coding rate for BPSK, QPSK, QAM16 and QAM-64 for coding rate ½ (2/3 for QAM-64) and ¾ as appeared in figure , it is discovered that the execution of the considerable number of frameworks is better for ½ (2/3 for QAM-64) code rate when contrasted with ¾ code rate

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