Original Article

Characteristic Analysis of Ofdm-Oqam System in Below Deck Ship Environment

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Abstract

In today's world ships plays vital role in transportation of people as well as heavy goods. So it is necessary to ensure the better communication network in ships as it contains many decks and compartments. Ships may face many dangerous situation such as fog, change in weather, fire on ship. And also the communication is required for manual or automatic engine room and pilot on boarding. During that time, it is important to have a good communication between the deck officer and engine officer. But it is one of the most challenging thing in wireless communication. MIMO OFDM is a wireless communication method that is being developed for 5G. When we combine OFDM and MIMO, we get a significant boost in performance in terms of data transmission rate, bit error rate (BER), Signal to Noise Ratio (SNR), and dependability. In this research, we compare OFDM with OQAM using the OFDM structure to obtain good performance in terms of low BER and SNR through the use of superior channel coding techniques and modulation schemes. To decrease the effects of Inter Symbol Interference (ISI) generated by multiple reflections, orthogonal frequency-division multiplexing (OFDM) has been proposed. Using numerous antennas for channel diversity has also been found to improve communications reliability and capacity. The supplied PP-SNR figures demonstrate the increased dependability that space-time coding can bring. The estimation of Shannon channel capacity shows that spatial multiplexing can take use of multipath scattering to boost performance and throughput. An enhanced strategy for wireless communication employing intensity modulation scheme is examined in the suggested system, keeping modulation complexity and reaching high power as significant considerations. The suggested OFDM modulation technique incorporates the OQAM-OFDM structure and the BPSK structure, which have been compared and developed to show the improvements on wireless communications.

Keywords: MIMO, OFDM, OQAM, Under Deck Environment, Bit Error Rate.

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INTRODUCTION

Incorrect or improper use of communication at sea level can cause various problems because ships holds tons of cargo and thousands of people and they might not be able to locate near if any rescue is possible. For the promotion of clarity and for the lowest risk of accidents in the sea, ships and other sea vessels must have to follow the careful communication deals. If the ship is under the captain's control or management deck department is responsible for the safe navigation and operation of the Ship both in the sea and in the port. The deck is a static cover on the compartments. The deck which is responsible for the length of the ship is known as main deck or deck 1.This is used for numbering the deck's. The ships may have different number of decks depends on their size. The deck are numbered sequentially above the main deck's are known as Levels that is 01 Level, 02 Level, etc. Below the main deck is referred as Deck 2, Deck 3, Deck 4, etc. It is important that the good communication between engine and deck officer's. But it is one of the most challenging thing in wirelesscommunication. The signal integrity may be compromised by repeated reflections caused by the metallic walls and doors of the compartments. In certain of the following situations, such as onboard fire, weather changes, fog, manual or automatic engine rooms, and pilot boarding, communication between the engine and deck is required.

EXISTING MODEL

With regard to the work in [6]. In normal circumstances, where SISO lines only accepted rates of 12 Mb/s, Throughput as high as 36 Mb/s was obtained, according to a presentation by Kevin Wanuga. With respect to the work in [1]. presented by Rofan Xavier X in 2016 Simulation research shows that the multi antenna system can increase communications performance over the single antenna in the below deck environment, but has very poor signal to noise ratio and bit error rate.

In reference to the proposed work, [7] published in 2019, Although the OQAM system has high bandwidth and no out-of-band suppression, it has low spectrum efficiency and requires CP. With regards to the work in, [3] using QAM presented by Nithya D, MIMO technology doubles the throughput and signal integrity of system despite of it is poor for changing environment factors.

- Inefficient Cyclic prefix Bandwidth.
- High out-off band emission.
- They have a high peak-to-average power ratio and are susceptible to carrier frequency offset.

All the above drawback of the existing system have been overcome this the proposed OFDM -OQAM technique is implemented.[8]

PROPOSED SOLUTION

1. Introduction

Reducing the complexity of the modulation, boosting the signal, and lowering the BER are crucial factors in the suggested study.

2. OFDM Signal Transmission and Reception

The input bit is modulated by means of the use of BPSK(Binary Phase Shift Keying) Modulator. where symbols are created from bits. The symbols, which all corresponding to the QPSK signals transmitted over each subcarrier, are transferred through a serial to parallel converter. The discreated frequency elements will be the output of the serial to parallel converter. By applying IFFT to these N symbols, these frequency aspects are converted to temporal area samples. The sequence X[n] of size N is produced by the IFFT as the OFDM symbol. The OFDM image is then given the CP (Cyclic Prefix) in order to lower ISI. A cyclic prefix of length sixteen is inserted for the subcarriers of N=64. The channel transmits the acquired signal. At the receiver end, the cyclic prefix can be eliminated. The time samples are transformed from serial to parallel and then increased using FFT. To improve the data, the BPSK demodulator is used after the FFT output. The wideband is broken down via OFDM channel into several narrowband subchannels, each of which is broadcast with extraordinary QPSK symbols. This shows that OFDM is being used.

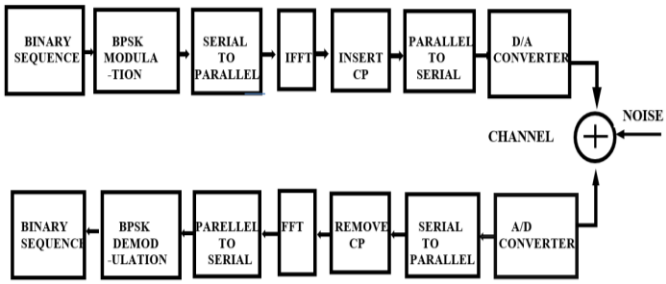

Figure 1. OFDM signal Transmission and Reception

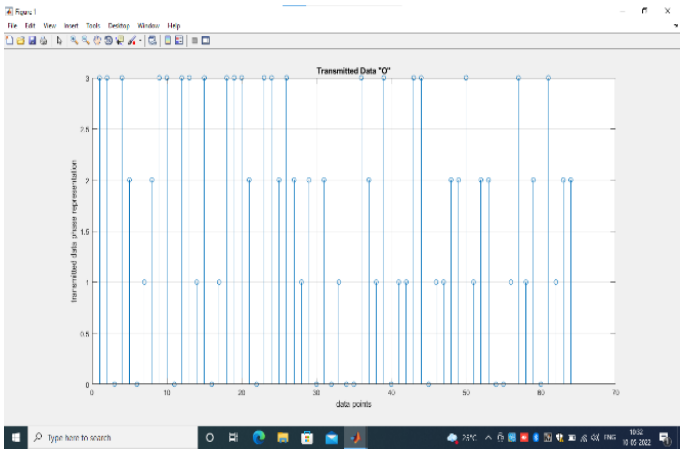

Figure 2. Transmitted signal

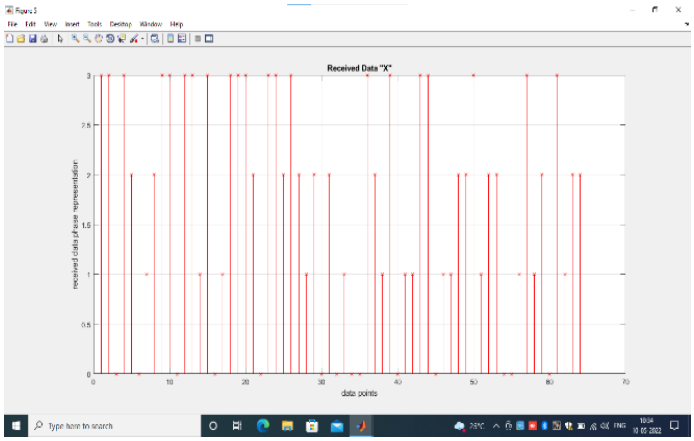

Figure 3. Received signal

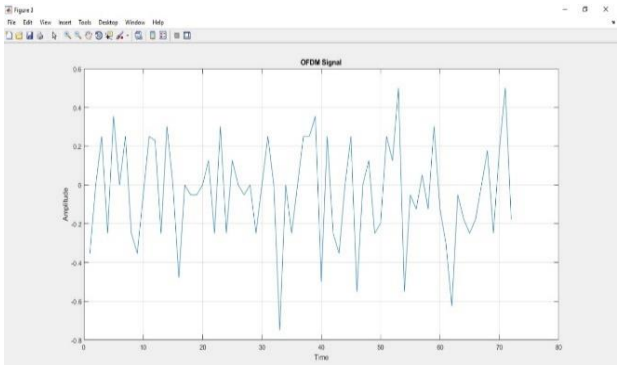

Figure 4. OFDM signal

3. IMPLEMENTATION OF OFDM-OQAM TECHNIQUE

The proposed model we used OQAM(Offset Quadrature Amplitude Modulation) along with OFDM. By using this model, the effective use of channel capacity and increase in transmission of bits can be obtained. OQAM will improve the data rate than in the existing system. Bit error rate will be reduced and it will further enhance the signal to noise ratio. The impacts of ISI brought on by numerous reflections are reduced with OFDM. Additionally, the reliability and capacity of communications will be increased through the employment of several antennas for channel diversity.

Communication with OFDM is efficient and less delayed. It turns a set of flat narrowband orthogonal fading channels from frequency selective fading channels. To do this, set the carrier signal to be equal to the reciprocal of the symbol period. The MIMO system increases communication capacity and reliability by reducing the impact of fading in wireless channels. OQAM is a multi carrier modulation which gives higher spectral efficiency with respect to conventional OFDM. This is primarily utilized because it can transport more information per symbol, increasing the link's data rate. Therefore it improves the performance and throughput. Thus the proposed model mainly focuses on intensity parameters with achieving high power efficiency.

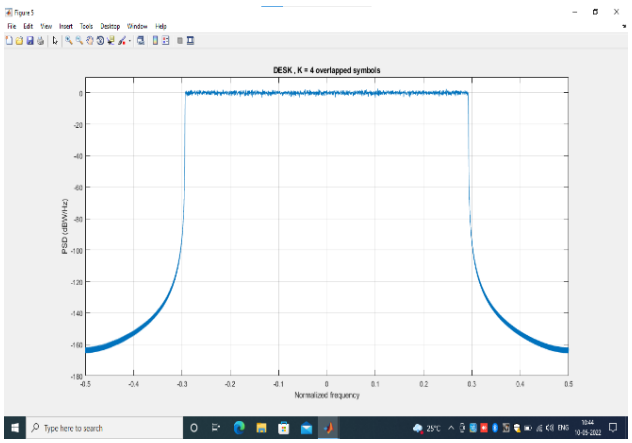

Figure 5. OFDM-OQAM system power spectrum density

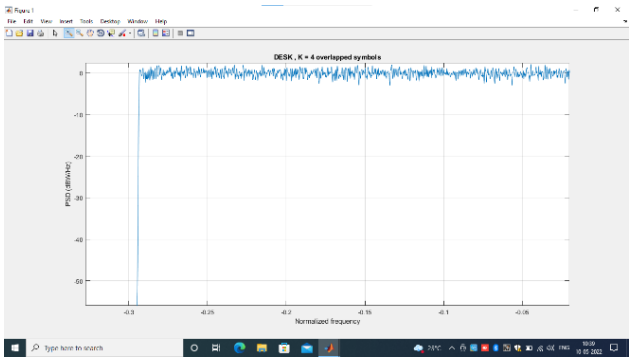

Figure 6.PSD of OFDM system

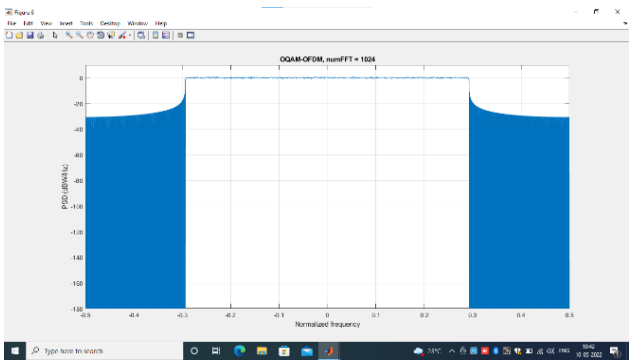

Figure 7. OFDM system power spectrum density

Analysis of Result

A comparative study has of OFDM-BPSK vs OFDM-OQAM modulation techniques. The result thus obtained shows that the proposed modulation technique is very much efficient in terms of bit error rate and Signal to noise ratio than the existing modulation scheme. The bit error rate obtained in the existing OFDM-BPSK model is 0.0309 and the bit error rate of proposed OFDM-OQAM model obtained is 0.0071377 at SNR = 12 db. Our study thus proves that the performance of OFDM-OQAM is better than OFDM-BPSK model in onship below deck environment.

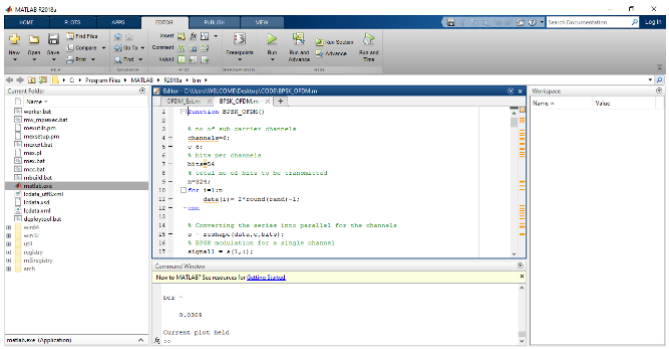

Figure 8. BER of OFDM-BPSK

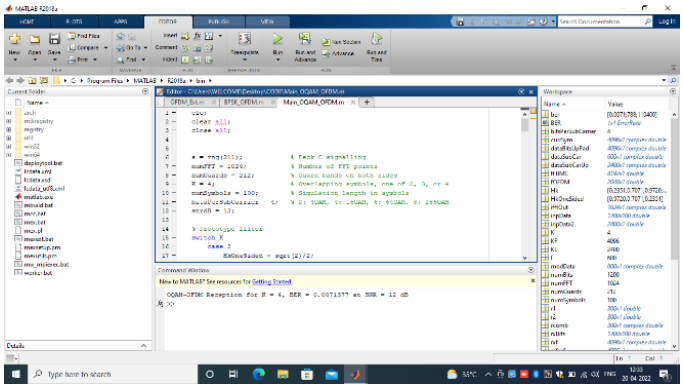

Figure 9.BER of OFDM-OQAM

Conclusion

The important solution for communication during shipping is to update with the recent under water communication technology. The improvement in these technology, need to make numerous improvements in the existing model, in order to upgrade the infrastructure and to maintain the maximum productivity and safety. OQAM modulation along with the convolution channel coding is used to examine the overall performance of the MIMO-OFDM system using a wide range of transmit and receive antennas. Thus the throughput was achieved as high as the existing system with viable communication and achieves high power efficiency. The proposed modulation scheme based on OFDM combines the OQAM-OFDM structure and BPSK structure comparatively studied and developed to show improvements on the wireless communication.

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