ISSN: 2277-9655
Impact Factor: 4.116
CODEN: IJESS7

IJESRT

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

DPSK-DWT OFDM SYSTEM FOR RELIABLE DATA TRANSMISSION USING BARCODE SYSTEM IN MOBILE DEVICES

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DOI: 10.5281/zenodo.164898

ABSTRACT

DPSK-OFDM modulation scheme is implemented in the proposed work to handle the complexity issue in flexible manner for hassle-free data transmission in mobile devices. Barcode scheme has ability to convert the readable form of information into un-understandable form to provide complexity free transmission. Barcode printed on paper has interference free appearance which does not have any leakages while digital barcodes has observed while pixels are leaked into their corresponding black pixels which is called as intersymbol interference. The proposed barcode based DPSK-OFDM system are designed to reduce the issues frequently occurs in handheld device transmission with low complexity and high performance as resultant outcome. The contribution work continued to proposed work is implemented on DWT-OFDM which results in low complexity than the proposed work with high performance as outcome.

KEYWORDS: Barcode, DPSK-OFDM, DWT, Data transmission.

INTRODUCTION

Communication industry has grown enormously in past six decades and supports various applications belong to different research fields. Wireless communication is major constituent of communication industry which has 75% of total market share. Wireless communication takes the communication domain to next level in terms of reliability and performance. Mobile data transmission is considered as 21st century system which offers higher data rate but suffers from complexity.

The stability of communication systems depends on modulation technique, if a system is deployed with equipped modulation mechanism it helps to achieve high efficiency and as well as better performance. Traditional modulation systems have limitations in its architectural design which restrict them to operate in proper way and the abnormal restriction results in complexity which eventually decline the total system performance. The research on modulation system reveals an interesting fact that the modulation scheme alone cannot perform entire task with accuracy and it needs additional barcode system to perform the modulation scheme with security. Barcode system based modulation framework achieves high performance along with nearly low complexity.

Barcode implementation in late 1950's has emerged as solution to security problems and became popular system for secured data transmission. Transfer of information is an interesting area in communication domain and transferring more information in less bandwidth is an assumption in analog systems while it became reality with introduction of barcode in digital systems. Encoding the information into un-understandable form provides security and the process is well accomplished by using barcode and 2-D QR code.

A novel barcode modulation system is proposed in this work to handle the complexity with ease and yields better performance with respect to low run time complexity. DPSK modulation along with OFDM is used for attaining higher data rates while barcode system is implemented in this work for high security provisions providing to data which is transferred between two devices with high accuracy. DPSK- DWT OFDM system has shown its supremacy over traditional algorithms in terms of performance and efficiency.

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Digitalization and its dependent digital gadgets make human life easy and comfortable. Invention of internet has take digitalization to next level. Mobile device invention is designed to meet various requirements in well-defined manner. According to international statistics, in 1990 for every 1 million people there is one mobile while in 2016 for 7 billion there are almost 15 billion mobiles are in usage. Although mobile device is considered as most prominent thing in daily life but still data transmission through mobile device is still concerned area in digital world. Various drawbacks are addressed in well-organized way in literature but still it is unresolved issue and the proposed work is proposed to solve the all issues in mobile transmission and justification of the proposed work relies how effectively proposed method handle the complexity issue.

A. Conventional algorithms proposed for handheld device transmission area miserably fail to achieve low complexity. Traditional barcode modulations mechanisms are based on PAM, BPSK and QPSK attains complexity levels more than 30% and high complexity levels makes handheld device transmission an unresolved issue in wireless transmission.

B. DPSK based barcode modulation scheme along with OFDM is newly implemented to handle the complexity issue in efficient way.

C. Handling the complexity with increasing performance another new thing implemented in this work

OBJECTIVES

1. High speed mobile transmission
2. Low complexity
3. Barcode scheme
4. High performance
5. Better efficiency
6. Reliability

RELATED WORK

Automatic systems introduction in wireless communications is consider as path breaking innovation which helps to transfer the information between two entities desired time with good accuracy and better performance. Manual data identification consumes more time which eventually declines the system performance and provides ample security measurements for securing data transmission proves from unnecessary distortions. 'Barcode technology' are vividly used various research fields for achieving creating automatic identification and data capture. Barcode modulation is explained as follows

(i) 1-D one-dimensional barcodes:
One-dimensional barcode appearance looks in a peculiar form consists of white and black lines in parallel form with essential spacing between them. Generally scanner reads the white lines excluding the black lines which decoding the barcode and it's the interesting fact about the one-dimensional barcode spacing consists of white and black lines.

(ii) 2-D Two-dimensional barcodes:
Two-dimensional barcode is a purely a graphical image which has ability to preserve the necessary information both in horizontal as well as vertical way. There are many 2D barcode are available from that some uses for camera phone applications these are QR code, visual code, data matrix, VS code. But along these codes QR code is more widely used in camera phone application since QR code is a unique code and it has a larger data storage capacity

ORTHOGONAL FREQUENCY DIVISION MULTIPLEXING (OFDM)

Orthogonal frequency division multiplexing (OFDM) and compatible usage in wireless standards like DVB, WIMAX, IEEE802.11a and LTE has been gained interest from worldwide research organizations. Recently an international meeting has conducted in order to discuss importance of orthogonal frequency division multiplexing (OFDM) and its usage in advance wireless standards makes Orthogonal frequency division multiplexing (OFDM) as an emerging technology to meet the requirements in practical scenario. Orthogonal frequency division multiplexing (OFDM) has high data rates compared to traditional communications systems and it suited well for frequency selective channels. Large delay spreads is a drawback which commonly occurs in the high speed wireless communication system and orthogonal frequency division multiplexing (OFDM) modulation scheme has

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ability to transform the wide frequency selective channel to narrow ones which creates the robust environment to resists against occurrence of the large delay spreads and preserves the Orthogonality in perfect way in the frequency domain. Orthogonal frequency division multiplexing (OFDM) has one more unique advantage to reduce the complexity in the system by introducing the cyclic prefix at the transmitter end and performing scalar equalization at the receiver end in the wireless standards like WIFI and WIMAX.

In 21st century, the role of the technology to offer high data rates and mobility is crucial and the technology is changing its face every other because of immense research work carried out on the advance wireless communications. Actually the research on parallel data transmission is traced out in the mid 1960's but it takes 25 long years to make it compatible to real time applications. The OFDM gradually seen its presence in the various application and now various international standards consider it as promising modulation scheme which initially supports wireless standards like WIFI, WIMAX, LTE etc. The two important parameters required better transmission of data from one entity to another are data rate and the modulation scheme should support different channel conditions to obtain better spectral efficiency.

The evolution of the third Generation Partnership Project (3GPP) development based on the Long term evolution (LTE) supports two networks namely Radio access network (RAN) and core network. The transformation of the 3G to 4G observes the changes in terms of data rate and spectral efficiency. International Telecommunication Union Radio communication Sector (ITU-R) initialized a set of requirements for the 4th generation cellular system and requirement of the high data rate is specified by International Mobile Telecommunications Advanced project (IMT-Advanced) for 4G. OFDM is a modulation scheme which is one of the techniques employed in LTE to enhance the data stream.

DPSK_OFDM

Demand for high data rate communication system leads to design of OFDM architecture which offers high data rate up to 100mbps. Introduction of blur in digital images has become a major concern area in the data transfer and usage of orthogonal subcarriers from OFDM has successfully handled the problem of image contamination. Orthogonal frequency division multiplexing scheme utilizes the low pass filter in efficient way to ensure the transfer of low frequency bits in uncontaminated way and only requirement needed is high phase coherency which helps in detect data bits in accurate and reliable way. A detailed explanation with well defined modification is presented in this paper based on above study and the proposed idea mainly relies on equipped modulation scheme along with LCD camera [9] movements which is used in capturing the single frame and the acquired images are perceived in better way.

DPSK modulation scheme is literally called as heart of the proposed work and adjacent frequencies phase differences leads to DPSK modulation. DPSK modulation usage comes into implementation when data is inscribed in phase differences based on the required movement tolerance. Finally DPSK-OFDM termed as DPSK method in entire project till end. Generally phase differences in data transfer results in phase distortion may affect the relative neighboring components in negligible way and usage of DPSK modulation handle the distortion situation in better way which paves way for transmission even in high LCD vicinity and in camera relative motion. A related figure composed of LCD camera movements along with communication standards is shown in figure 1 and the mechanism presented above successfully eliminates the unnecessary channel estimation requirements which results in low processing power.

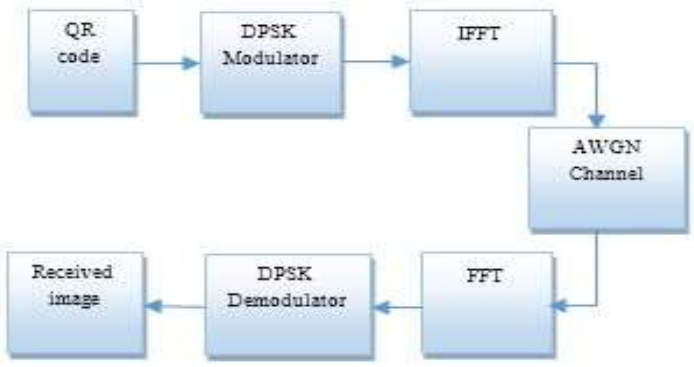

Figure 1: Transmission of information using DPSK Algorithm

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Impact Factor: 4.116
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Transmission information from the transmission end at maximum level is a concerned area especially from a single image and in order to meet the criteria, maximum data must be extracted from the single which is followed by increasing the data rate of the consecutive frames for decoding purpose. Extraction of the information depends on the LCD display design while in some cases it depends on the receiver end camera respectively.

(A) DATA CAPACITY

Data capacity is crucial part in data transfer from transmission end to receiver end though channel. Number of bits viewed on LCD screen especially of raw image. A color image shown on display composed of rows and columns as 'M' and 'N' and transmission of data is done through channel represented as L_D and depth of color bit $B_D$bits per channel. The maximum information is represented as

$$C_I = M_D \times N_D \times L_D \times B_D \; bits\; per\; image \; \ldots (1)$$

The discrete nature of the LCD display puts serious limitations to perceive maximum information as shown in above notation and desired information rate cannot be achieved due to certain limitations as described below.

(i) Power related Limitations

According to the Shannon hypothesis theory, the power passing through channel is directly depends on the signal force. The signal force represents the speed achieved by the respective signal while it sent through the medium in effective way. So power limitations deployed in the communication theories pose major limitation is transmitting the information using barcode modulation. The major reasons which vividly cause power limitations are as follows

- Signal compression while transmission results in distortions. These compression distortions are the one of the predominant reason for causing power limitations.
- Subjective relative motion

(ii) Finding the relevant patterns

Modulation/demodulation is considered as heart of the modern day communication system which is offering high data rates to various indoor and outdoor applications by international communication standards. Extraction of inscribed information from respective barcode modulation is highly affected by power distortions. Standard finder pattern used for QR code is 1:1:3:1:1.

(C) DPSK – OFDM

Transmission of information through wireless scenario is possible because of reliable modulation schemes. In traditional approaches vast amount of modulation schemes along OFDM has implemented but none can achieve low complexity. In this work, DPSK-OFDM modulation scheme has implemented for better transmission of information from transmitter end to the receiver end. The transmission of information through DPSK OFDM approach is shown in following figure 1.Here the respective input taken is 'TEXT'. The encoding process helps in achieving secured QR code for reliable transmission. Encoding and decoding of QR code is achieved by Zxing open link source [10]. Cyclic extension is used to prevent the inter carrier interference (ICI) in a OFDM system [7].

(i) DPSK Modulator

DPSK takes the converted data as a input source. Each symbol is converted to a complex phase by following rules $11 \rightarrow e^{\frac{j1\pi}{4}}$, $10 \rightarrow e^{\frac{j7\pi}{4}}$, $01 \rightarrow e^{\frac{j3\pi}{4}}$, $00 \rightarrow e^{\frac{j5\pi}{4}}$,

First bit modulates the Real component & second bit modulates the imaginary component of the phase of each symbol.

S matrix converted into Differential matrix D using following method:

- $D(0,0)=S(0,0);$ (2)
- $D(0,n)=D(0, n-1) \times s(0,n) 1 \leq n < N-2$ (3)
- $D(m, n)=D(m-1,n) \times s(m,n) 1 \leq m < M/2-1,\ 0 \leq n < N-2$ (4)

D matrix is converted into two matrices:

- $D_1(m,n)=D(m,n);$ (5)
- $D_2(m,n)=D(m,n+N-2/2\ ;$ (6)

Where $0 \leq m < M/2-1,\ 0 \leq n < N/2-1$

These two matrices are used to fill regions 1 and 2 of the transmission matrix.

ISSN: 2277-9655
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(ii) IFFT

IFFT is used to convert the frequency domain data into time domain. Output of DPSK modulator is in frequency domain, so IFFT is used to convert it in Time domain representation using following equation:

$$\mathbf{X[n]= \sum_{k=0}^{N-1} X(k) . e^{\frac{jk2\pi n}{N}} n = 0, 1, 2, \dots, N-1} \quad (7)$$

(iii) AWGN channel

AWGN channel is widely used in OFDM. In OFDM multipath signals are transmitted then these signals are received as a train of pulses at the receiver .In this white Gaussian Noise are considered with constant spectral density.

(iv) FFT

FFT is used to convert time domain representation of data into frequency domain using following equation:

X[K]=1/N

$$\sum_{n=0}^{N-1} x[n]. e^{\frac{j2\Pi nk}{N}} k = 0, 1, 2, \dots, N-1 (8)$$

(v) DPSK Demodulator

Data can be extracted using phase differences between respective elements. Data corresponding to region 1 & 2 should be concatenated to form matrix R corresponding to transmitted matrix T.

- Rd(0,0) =R(0,0) (9)
- Rd(0,n) =R(0,n)×R*(0,n-1)0<n<N-2 (10)
- Rd(m,n)=R(m,n)×R*(m-1,n)0<n<N-2, 0<m <M/2-1

Finally, the received signal is to be detected as the phase differences have been extracted. Each input bit may be calculated using constellation map of the transmitter. Each element is evaluated using its real and imaginary components. The sign of the real component determines the first bit and sign of the imaginary components determines the second bit.

In wireless medium to increase the data rate with high performance orthogonal frequency division multiplexing (OFDM) is used which uses inverse fast fourier transform at the transmitter to modulate a high bit rate signal onto a number of carriers. The problem to this technique is that it requires more complex IFFT core. Over this, we can use discrete wavelet transform to generate the output with lower computational complexity.

RESULTS

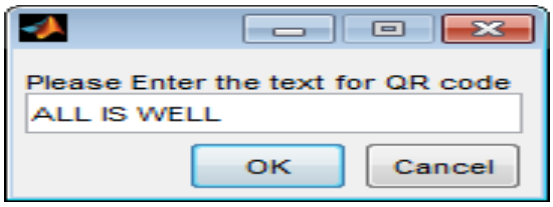

Figure 2: Input Text

Fig.2. Analysis: The first step is to enter the text to generate a QR code. Our main aim is to retrieve the entered text back. So, now I have entered “ALL IS WELL”.

Figure 3: Generated QR Code

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Figure 3: Analysis: The text which was entered is generated as a QR code as shown in the above Fig.

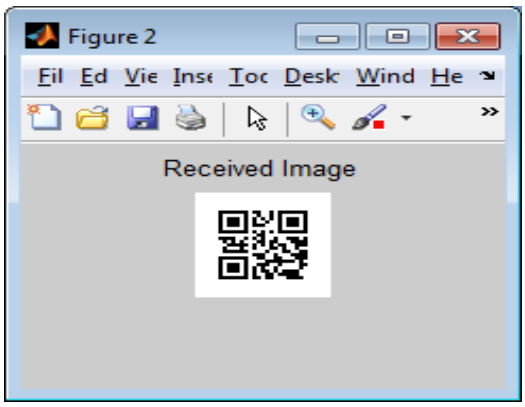

Figure 4: Received Image

Figure 4: Analysis: The generated QR code is captured by the receiver and this is analysed to extract the text entered.

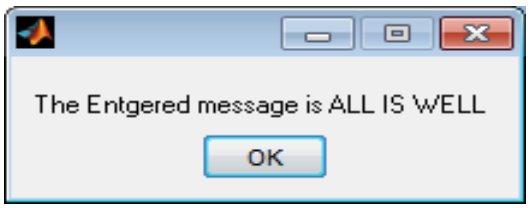

Figure 5: Shows Entered Text

Figure 5: Analysis: Finally the above QR code is analysed and the original text is retrived as shown in above Fig.

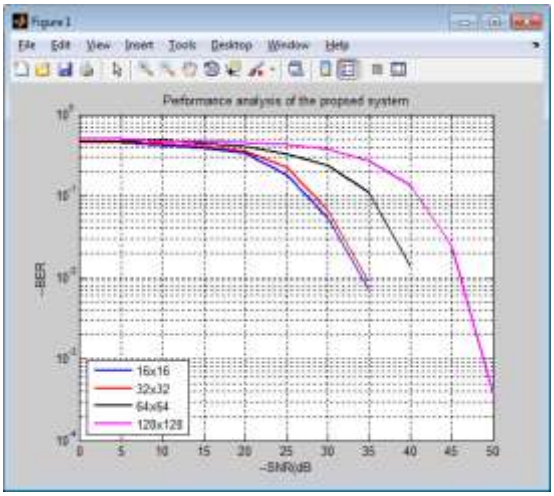

Figure 6: Performance Analysis of Proposed Method

Figure 6: Analysis: Now the next step is to analyse the performance of the received QR code for16×16, 32×32, 64×64, 128×128. The above figure shows as the bits size increases BER also increases. So, our main Aim is to reduce BER and for 16×16 the BER has got reduced.

CONCLUSION

In this work a novel DWT based DPSK OFDM approach is proposed to design a framework for implementation of better handheld device communication to support various applications. By using DWT instead of fourier transform, we reduced the BER. Reduction in BER results into better performance in transmission data and picture

ISSN: 2277-9655
Impact Factor: 4.116
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blure reduces and we can received a cleared image of QR code. The performance is measured in terms of BER and SNR. As SNR increases BER decreases in DWT-OFDM instead of FFT-OFDM.

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