

Efficient Data Transmission with Barcode Modulation Based On DPSK-OFDM

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Abstract

In digital communication for transmission of very high data in secure and efficient way is the new approach for wireless communication system. So many techniques are developed to transmit the data in secure as well as in small space but all techniques are having some drawbacks. Large data encryption in small space and data privacy is two drawbacks leads to manipulations in handheld mobile transmissions. For transmission purpose we used image processing as well as communication concepts. In this paper we used DWT for barcode modulation in handheld devices to transmit the very high data through DPSK-OFDM. Using DWT in barcode modulation for data transfer we are getting high accuracy and low complexity which can be shown by SNR vs. BER performance.

Keywords: Barcode modulation, OFDM, DWT, DPSK

1. Introduction

The world of communication improved lots in past century and therefore the change starts from analog communication followed by digital communications that is then followed by virtual growth. Despite the technological advancement still applications like business, advertising, and supply depends heavily on physical media for communication. Data communication has wide selection of applications in present time however still the domination of paper remains continued in numerous applications and this cause a scenario of your time consumption. Barcode implementation has modified the state of affairs and implementation of barcode will increase communication and improvise the communication in terms of knowledge rate.

Data transmission through barcode has gained nice prominence that guarantees secret writing information that ensures data privacy in reliable means by excluding the information piracy. causing a lot of knowledge exploitation

less area for equipped transmission has attain attention and barcode is one application that takes less area for transmission a lot of knowledge. . QR code [1] is another illustration of barcode and has its own benefits in terms of secret writing and decryption. Concealment for secure transmission is enforced in real time by changing the several data into reliable QR code then followed by DPSK together with OFDM modulation theme for achieving the secure transmission in numerous data communication applications.

Barcode technology is assessed into 2 type's specifically (i) one-dimensional barcodes and (ii) Two-dimensional barcodes supported the appliance headed secret writing mechanisms. One-dimensional barcode look appearance in a very peculiar type consists of white and black lines in parallel type with essential spacing between them. Usually scanner reads the white lines excluding the black lines that decryption the barcode and it's the fascinating reality regarding the one-dimensional barcode

spacing consists of white and black lines. Two-dimensional barcode may be a strictly a graphical image that has ability to preserve the mandatory info each in horizontal also as vertical means.



Fig.1 1-D Barcode



Fig.2 2-D Barcodes

The major differences in terms of advantages are shown in tabular column 1 as follows.

CONTENTS	ONE-DIMENSIONAL BARCODE	TWO DIMENSIONAL BARCODE
Data capacity	Low data capacity	High data capacity
Additional storages	Needs additional storages	No additional storages
Error correction ability	No error correction ability	Have error correction ability

Tabular column 1: One- dimensional barcode vs. Two-dimensional barcodes

Two-dimensional barcode have way more advantage over the one-dimensional barcode [8] that's why 2-D barcode most generally used. 2-D barcodes generates some uses for camera phone applications these square measure QR code, visual code, information matrix, VS code. However on these codes QR code is a lot of wide utilized in camera phone application since QR code may be a distinctive code and it's a bigger information storage capability [3].The detection of QR code by mobile phone in[11].

Transmission of data between two mobile devices through a series of 2D QR codes is studied in [5], achieving bit rates of under 10 kbps. Further idea is developed in [4], in which a monitor of computer and a digital camera are used for transmission and reception with bit rates more than 14 Mbps. This rate is drop to 2 Mbps as distance increases up to 4 meters from 14 meters. The better performance is achieved by using more effective modulation schemes. The general idea is to use inverse Fourier transform of data like OFDM to modulate LCD pixels studied in [2]. DWT have much more advantages over the Fourier transform as in [6]. For further increase in performance is achieved by using wavelet transform (DWT) instead of Fourier transform along with DPSK-OFDM is to be studied in this paper. The performance is to be measured in terms of BER (bit error rate) and SNR (signal to noise ratio).

2. OFDM

Orthogonal Frequency Division Multiplexing (OFDM) is the multicarrier parallel transmission system which is used to transmit the data with very high data rate. The main thing in OFDM is signal must follow orthogonality property. So that we can place the signals with overlapping. As signals are placed with overlapping the bandwidth required to transmit the data is very less and time required to access the data also very less. As time required to transmit the data is reduced we are getting very high data rates.

Wireless network has witnessed forceful enhancement in terms of information rates from previous couple of years starting from 10Kbps to 10Mbps and typically on the far side that limit. The demand of high speed communication in

wireless networks increasing attributable to advancement in technology. Broadband channels expeditiously utilized the modulation schemes and its properties in effective to provide high speed communications for various wireless applications. The data analysis and information system of OFDM area unit in parallel and distinctive approach of OFDM is dividing the channel into sub channels for supporting multi carrier modulation theme. Channel division into sub channel helps in making the orthogonality at transmitter aspect and separation of the sub channels at the receiver section. About initial serial information images area unit changing to parallel information stream and every parallel information stream has sub channel and therefore the image rate of individual sub channel is lower compare to original channel symbol rate. Because, the image rate of sub channel is under original channel image rate that makes sub channel look appears like as flat attenuation channel. OFDM has advantage of avoiding adjacent sub channels distortion is effective method by additive burst noise in random method. OFDM could be a versatile modulation theme to combat against the interferences by inserting guard intervals and has ability to supply high rate.

OFDM scheme is strictly designed to offer high speed communications for different applications and users respectively. ITU-RF approves OFDM as future generation system which offers high data rate, low complexity, no interferences and finally better spectral efficiency. Although OFDM offers wide range of advantages but drawbacks like PAPR, timing jitter frequently decline the performance levels along with cost of the system. Orthogonal frequency division multiplexing (OFDM) communication model has following factors

- (a) Spectral efficiency
- (b) BER performance
- (c) Attenuation factor
- (d) Channel factors
- (e) High power amplifier
- (f) Orthogonality

3. Proposed Method

Demand for very high data rate communication system results in style of OFDM design that offers high rate up to 100mbps. Introduction of blur in digital pictures has become a significant concern space within the knowledge transfer and usage of orthogonal subcarriers from OFDM has with success handled the matter of image contamination. Orthogonal frequency division multiplexing theme utilizes the low pass filter in economical thanks to make sure the transfer of low frequency bits in uncontaminated approach and solely demand required is high part coherency that helps in discover knowledge bits in correct and reliable approach. In depth clarification with well outlined modification is bestowed during this paper supported higher than previous study and therefore the projected plan primarily depends on equipped modulation them at the side of digital display camera [9] movements that is employed in capturing the one frame and therefore the no inheritable pictures area unit perceived in higher approach. DPSK modulation is virtually known as as heart of the projected work and adjacent frequencies part variations results in DPSK modulation. DPSK modulation usage comes into implementation once knowledge is inscribed in part variations supported the specified movement tolerance. Finally DPSK-OFDM termed as DPSK technique in entire project until finish. usually part variations in knowledge transfer ends up in part distortion could have an effect on the relative neighboring elements in negligible approach and usage of DPSK modulation handle the distortion scenario in higher approach that have approach for transmission even in high digital display neck of the woods and in private relative motion.

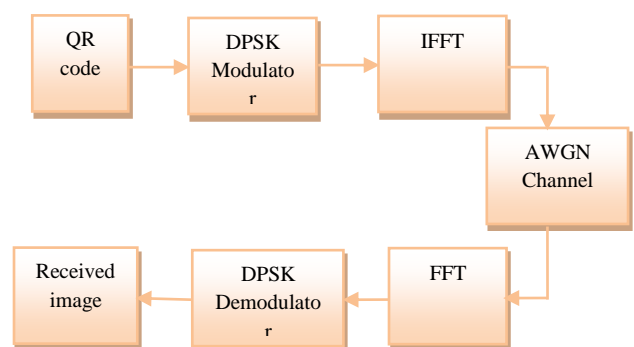


Figure 1: Transmission of information using DPSK Algorithm

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 very important parameter in barcode modulation. We want to transmit very high data in very small size frame so we have to think about the capacity which can be maximum transfer of data through barcode. 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

$$C_I = M_D \times N_D \times L_D \times B_D \text{ bits per image ... (1)}$$

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

As we are using electronic devices to transmit or receive the barcode, in our project we are using mobiles for transmission purpose. Electronic devices are known as they are using very low power for transmission and reception purpose. We have to use such system that uses very less power for their transmission.

The major reasons which causes power limitations are as follows

1. Signal compression while transmission results in distortions. These compression distortions are the one of the predominant reason for causing power limitations.

2. Subjective relative motion

(ii) Finding the relevant patterns

Proper modulation and demodulation techniques are used to get very high data rate. Modulation index in OFDM is based on number of signals to be transmit and as well as FFT size. 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

Mostly DPSK technique is phase shift keying technique which uses one and half cycle for modulation. 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. 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:

$$\bullet D(0,0) = S(0,0); \quad (2)$$

$$\bullet D(0,n) = D(0, n-1) \times s(0,n) \quad 1 \leq n < N-2 \quad (3)$$

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

D matrix is converted into two matrices:

$$\bullet D_1(m,n) = D(m,n); \quad (5)$$

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

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

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

(ii) IFFT

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

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

(iii) AWGN channel

AWGN channel is considered with constant noise spectral density. AWGN is noise channel used to get practical results for barcode modulation.

(iv) FFT

FFT will convert the signal from time domain signal to frequency domain as shown below,

$$X[K] = \frac{1}{N} \sum_{n=0}^{N-1} x[n] \cdot e^{\frac{j2\pi nk}{N}} \quad k = 0, 1, 2, \dots, N - 1 \quad (8)$$

(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.

$$R_d(0,0) = R(0,0) \quad (9)$$

$$R_d(0,n) = R(0,n) \times R^*(0,n-1) \quad 0 < n < N-2 \quad (10)$$

$$R_d(m,n) = R(m,n) \times R^*(m-1,n) \quad 0 < n < N-2, 0 < m < M/2-1$$

Finally we have to use constellation mapper to get exact output or data transferred through barcode that is nothing but number of bits or signals transmitted. 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. Extension diagram is as shown in figure 2. Wavelet transform is the most suited for use in AWGN channel and measures the performance in terms of Bit Error Rate (BER) and signal to noise ratio (SNR). It increases the spectral efficiency and decreases the bit error rate as compare to Fourier transform and we get the better performance.

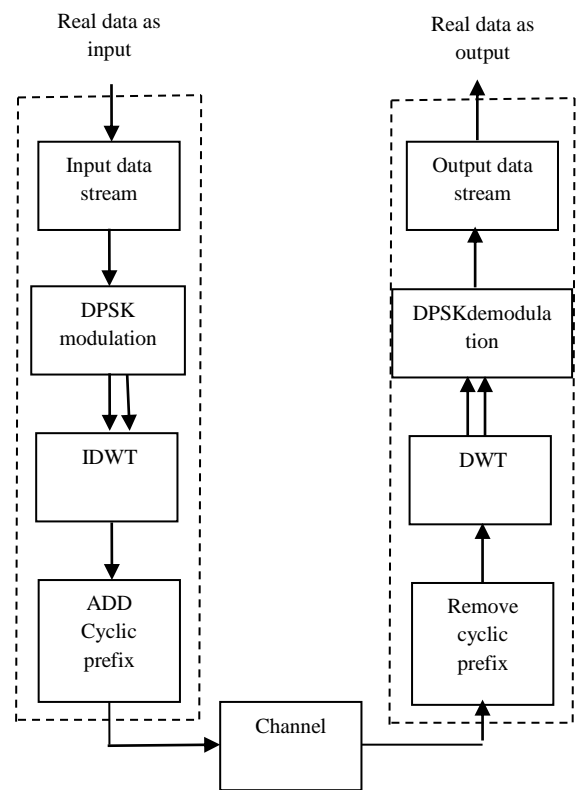


Figure 2: Extension method block diagram for data transfer using DWT

4. Results

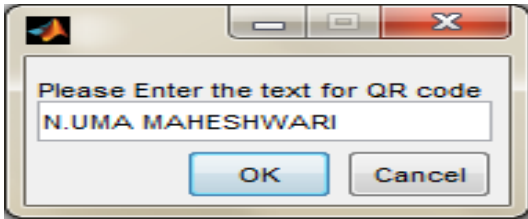


Fig. 3: Input Text for QR code

Fig.3. shows the first step is to enter the text to generate a QR code. We entered the text “N.UMA MAHESHWARI”.After that we will go for encoding this data into QR code.

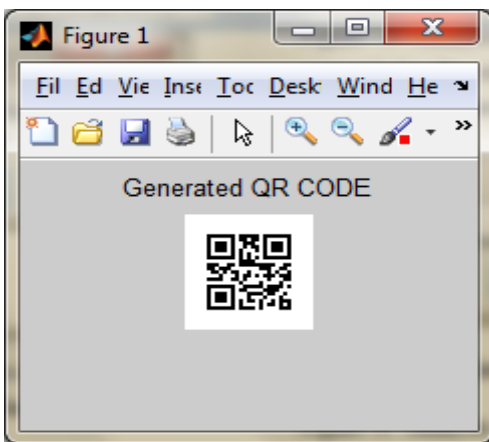


Fig. 4: Generated QR Code Image

Fig. 4 shows that the above entered text is encoded in QR code.

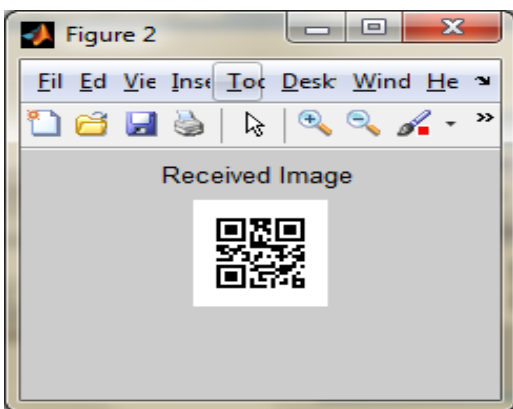


Fig.5: Received QR code Image

Fig.5 shows that the generated QR code is captured by the receiver and this is analyzed to extract the text entered.

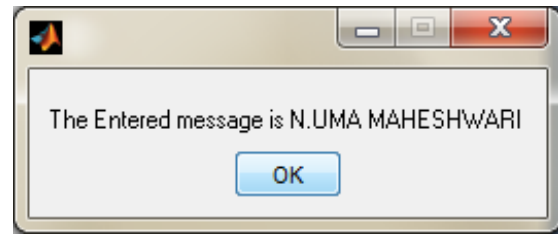


Fig.6: Shows Entered Text

Fig. 6 shows finally the above QR code is analyzed and the original text is retrieved as shown in above Fig.6

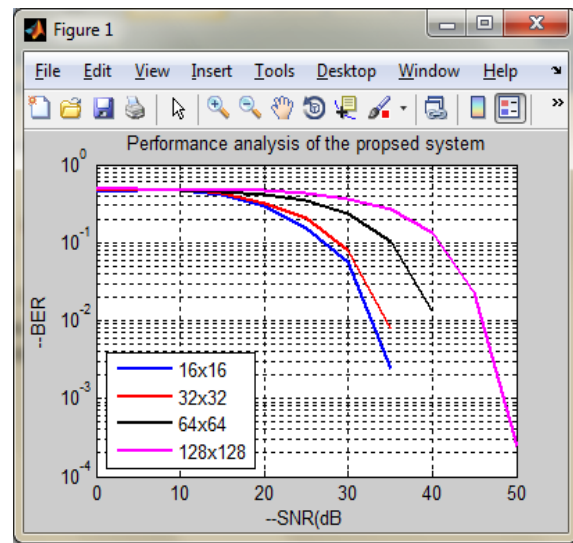


Fig.7: Performance Analysis of Proposed Method

Fig.7 shows that the next step is to analyses the performance of the received QR code for 16×16 , 32×32 , 64×64 , 128×128 . The above figure shows as the frame size increases BER also increases.

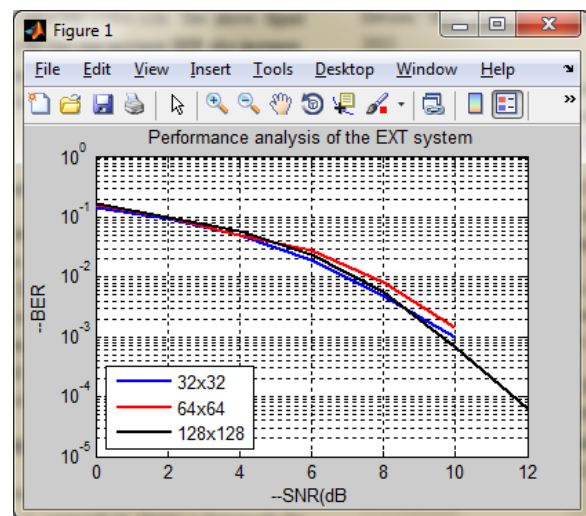


Fig.8. Performance Analysis of Extension Method

Fig.8. shows that the above performance is the extension of the proposed method. In this Discrete Wavelet Transform (DWT) is used to increase the SNR as well as to reduce the BER. The performance is Shown for 32×32 , 64×64 , 128×128 . As compared to the proposed technique BER is much more less in the extension method.

5. Conclusion

In this work efficient and secure transmission of data using barcode modulation based on DWT in DPSK OFDM is proposed successfully using MATLAB simulation. With the help of DWT, we reduced BER effectively. Reduction of the BER gives better performance for transmission of very high data in secure and efficient manner using QR code. With the help of results of simulation SNR vs. BER graph, we can get that performance of the DWT based DPSK-OFDM gives high efficiency. We observed that proposed technique gives better results for high data also.

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