

DWT BASED BARCODE MODULATION FOR EFFICIENT AND SECURE DATA TRANSMISSION THROUGH DPSK-OFDM

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Abstract: There is need of data transmission scheme which is very fast, efficient and secure. Different techniques are developed to enhance this transmission process by using barcode modulation method. In handheld transmission it's very important to transmit the data in very small size and data should be highly secure. Barcodes are used everywhere nowadays because of its superior advantages over manual use of data. Advantages like high security, high capacity, run time complexity, error correction ability as well as very high storage ability made barcode famous for use. Here in this paper we are using communication concepts for transmission and image processing concepts for data storage in barcodes. 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, LTE, BER, OFDM, DWT

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 improve the communication in terms of knowledge rate.

We are going to consider following things for better implementation

- A. Similarities of Barcode and the wireless RF channel.
- B. Transmitter with less PAPR transmission of the signal.
- C. Cyclic extension should be more than the time spread of the channel.
- D. Fair copy of the image is created by using proposed algorithm at receiver.
- E. Error correction coding is used for correction of the number of bits lost in the transmission process.
- F. Two-dimensional (2D) barcode technology has become popular and useful for communication. In general, QR code stores more data when compared to 2D barcode. The size of the QR code depends upon the amount of data stored. The main aim of this project is to create a QR code and transmit from one section to other section with high efficiency and data rate.
- G. CDMA based data transfer in mobile transmission systems suffer from low data rate and high complexity. OFDM communication system is replaced in place of CDMA along with DPSK modulation scheme to transfer the data in unreadable form through multiple transmitters to multiple receivers using channel as medium.



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.

Table -1: One- dimensional barcode vs. Two- dimensional barcodes

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

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).

1.1 OFDM (Orthogonal Frequency Division Multiplexing)

OFDM is a latest technology which is used in 4G wireless networks for increasing the speed of transmission. Main advantage of the OFDM system is availability of multiple carriers. Due to availability of the multiple carriers we can give access to more data as compare to the previous techniques. Because in previous techniques there is availability of single carrier. Existing systems like TDMA (Time Division Multiple Access), FDMA (Frequency Division Multiple Access) and CDMA (Code Division Multiple Access) uses only single carrier. But the drawback of existing system is as there is availability of the single carrier they cannot give access to the more signals at a time.

We studied all the drawbacks of the existing systems and we are going to study efficient transmission of data using OFDM as well as its drawbacks and how to overcome its drawbacks to make OFDM more efficient.

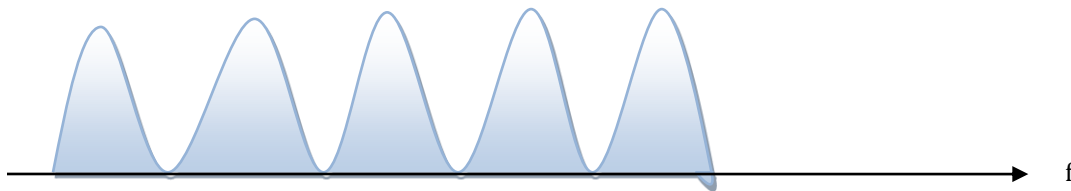


Fig-3: Previous Techniques (e.g. FDM)

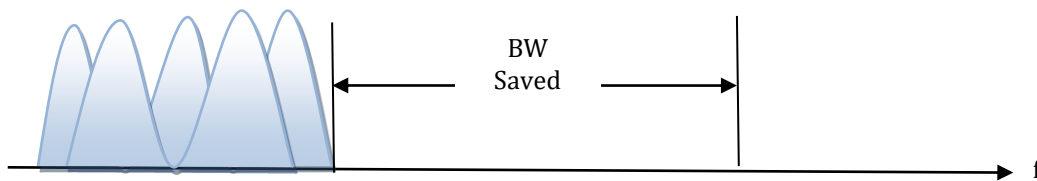


Fig-4: Overlapping in OFDM (LTE)

It is the technique of combine more data in efficient bandwidth so that the bandwidth used should be very less and time required to access the data is also very less. Data rate nothing but data per time. So, we can conclude that as time required to access same data as previous is less then data rate should be very high.

But while going to do so the subcarriers must follow orthogonality property. If they follow orthogonality property then only we can place the signals with overlapping. Due to overlapping there is less requirement of bandwidth. So, we can say that bandwidth is efficiently used. Efficient use of bandwidth is very important concern in digital as well as audio broadcasting. Both digital broadcasting and audio broadcasting we are going to use OFDM systems.

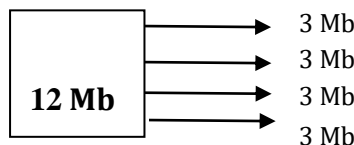


Fig-5: Serial to parallel converter

As we can see above figure the main Moto or main agenda of the OFDM system is reducing the bandwidth required to abruptly less. Due to availability of the single carrier in previous techniques, the bandwidth required to very high extent. But by using multi carrier there is very less bandwidth required as we can do this into small chunks and can pass it through very less bandwidth by keeping global orthogonality. Orthogonality is important concern deal with LTE. One important aspect is

maintaining orthogonality between overall subcarriers. If we transmitted the signal with orthogonality and overlapping is allowed then BW is saved as well as time required is very less. As time parameter is very less, the data rate is increased to great extent.

So, finally we can conclude that if we are using the OFDM is nothing but we are going for high speed application

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 those 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 a 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.

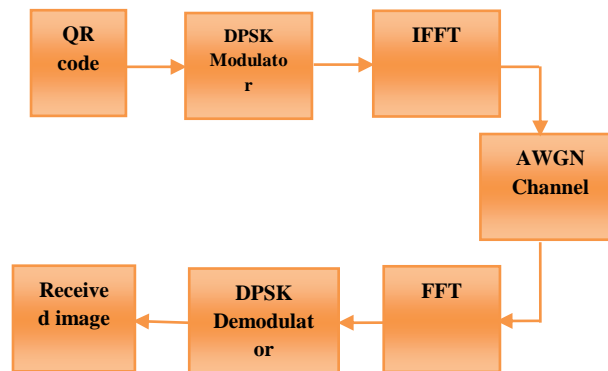


Figure 1: Transmission of information using DPSK Algorithm

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

Transmission of data samples from transmitter entity to receiver entity is meant for data transfer and large amount of information is transfer through equipped system with higher data rates. The data transfer between transmitter and receiver through channel is color images. Color image pixels information belongs to RGB image is represented in number of rows and columns 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

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

(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

(B) Receiver

To get the fair copy (D_a) of the transmitted or acquired image, the receiver uses its camera for operation on acquired image like sampling, registering. We are going to consider different effects of the distortions on images as well as effect of noise and interference on the image while simulation. We must follow the following rules to get exact transmitted data at the receiver side.

At receiver side following steps are taken into consideration

1. Image Capture

2. Image Registration

3. Fast Fourier Transform (FFT)

4. DPSK demodulation

5. Detection

(C) DPSK – OFDM

When pixel to pixel isolation is improved in image processing technology but capturing of image have some distortions this will effect on barcode image pixel and produces inter symbol interference. To overcome this interference in barcode image we already know that many ideas were implemented got the successful results in reducing the ISI interference in signals. Instead of transferring bunch of narrow band signals in single high transmission line the system is more efficient to transmit these signals in parallel

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. OFDM modulation technique efficiently deals with fading, band limited, power constrained, multipath channels in communication channels.

(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:

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

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

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:

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

(iii) AWGN channel

For practical applications we are going to consider one of the famous noise model is additive white Gaussian noise model.

It considers both white noise which is noise due to temperature and it's added after particular distance. The name Gaussian came from Gaussian shape. Resultant shape we got is Gaussian shape.

(iv) FFT

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

$$X[K]=1/N$$

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

(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.

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

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

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

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.

D. Significance of the Method used

Mostly this proposed technique having the significance of the getting good results if there is versatile situations like camera movements, picture blur and light leakage within the neighboring pixels.

In band distortions produced while transmitting the barcode causes serious degradation in original barcode at the transmitter side, to overcome this type of problems we are going to use the DPSK-OFDM system which is dealing with the problems like band limited, power constrained, multipath channels, it is more efficient to transfer a bunch of narrow band signals in parallel instead of a single high bandwidth signal.

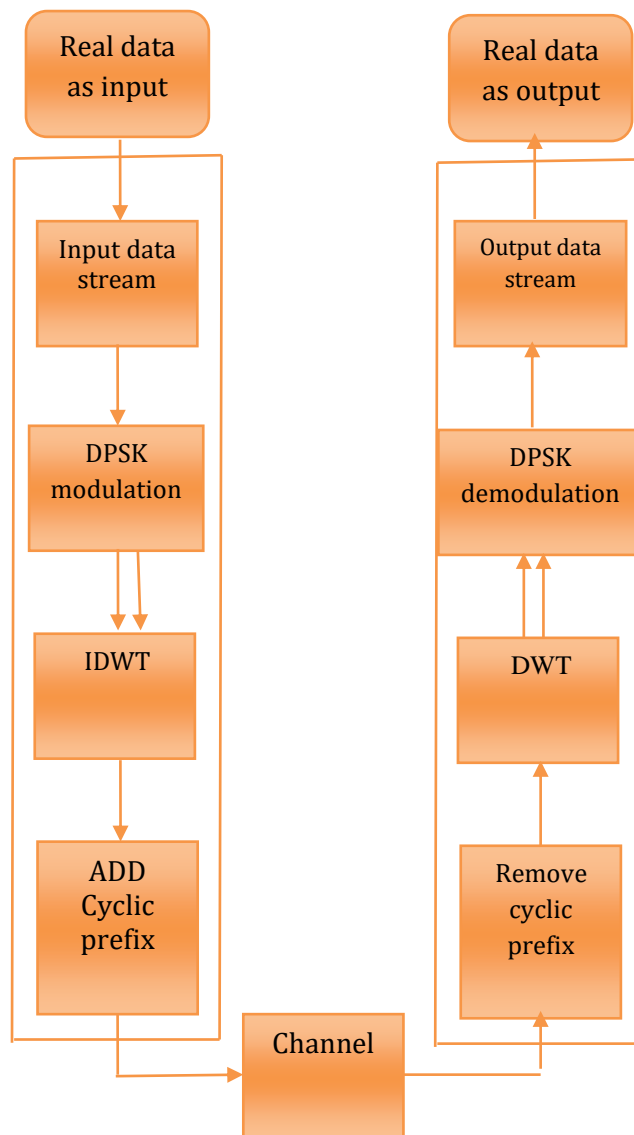


Figure 2: Extension method block diagram for data transfer using DWT, through DPSK-OFDM

4. RESULTS

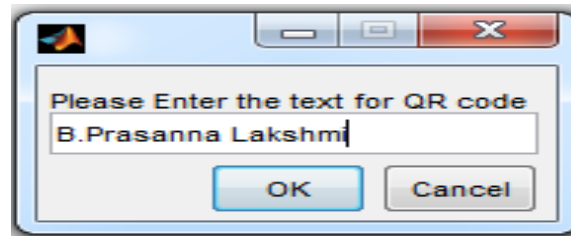


Fig. 3: Enter the text for which you want to generate barcode

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

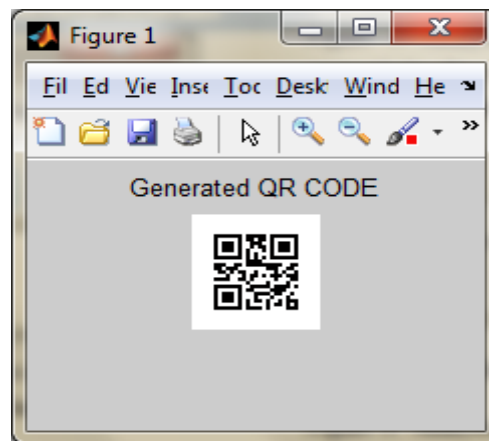


Fig. 4: Generated QR Code Image for entered text

Fig. 4 shows that the above entered text is encoded in QR code (we also used some java files to scan that barcode)

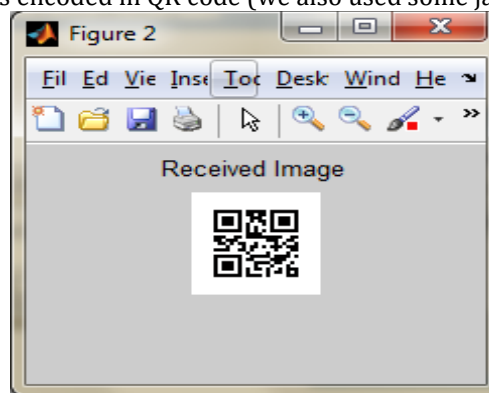


Fig.5: Received QR code Image at the second mobile

Fig.5 shows that the generated QR code is captured by the receiver and this is analyzed to extract the text entered (for extraction of that data we used some java files)

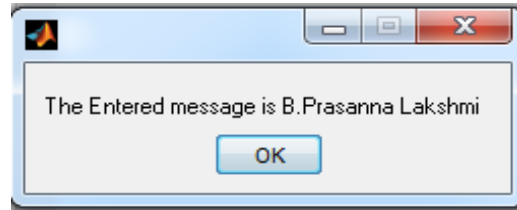


Fig.6: Entered text is extracted from Barcode

Fig. 6 shows finally the above QR code is analyzed and the original text ('B.Prasanna Laxmi') is retrieved as shown in above Fig.6.To scan the generated barcode we used some java files.

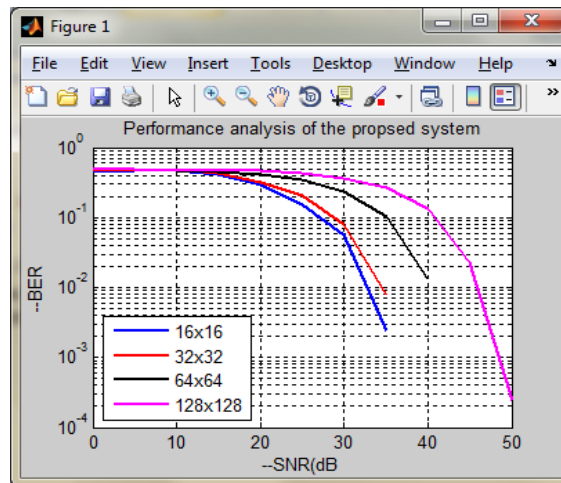


Fig.7: Performance Analysis of Proposed Method

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.

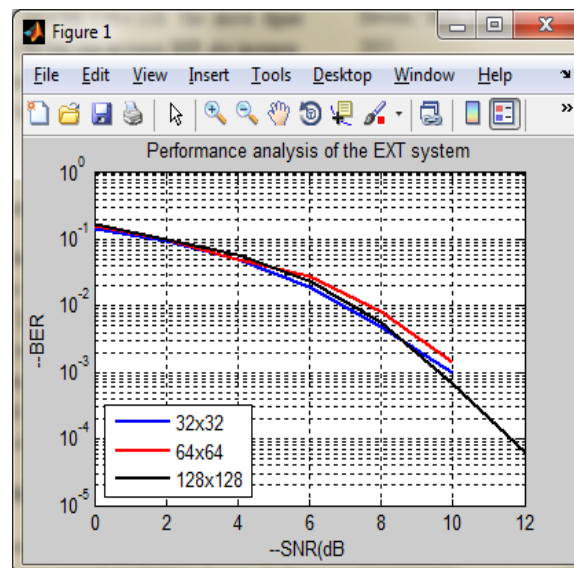


Fig.8.Analysis of Extension used (DWT)

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. BER is one of the quality assessment parameter which will recall that results got by extension method are much better than previous techniques of barcode generation.

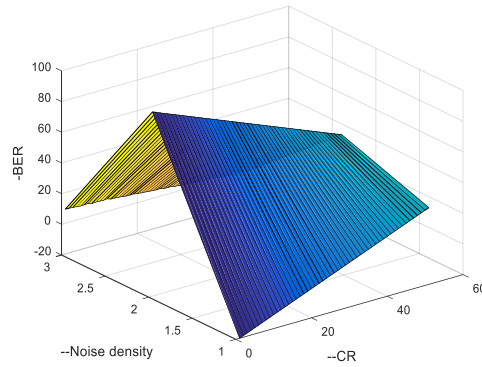


Fig.9 3-D plots for performance analysis of DWT based DPSK-OFDM for barcode modulation.

Further 3-D graphs are analyzed to know more details of the results got or analyzing a system.

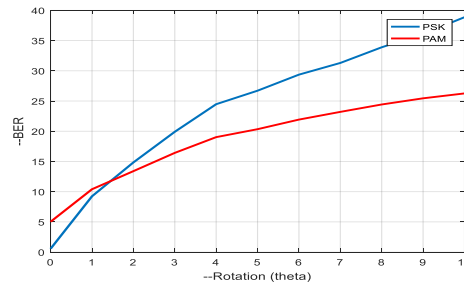


Fig. 10 BER analysis of the PSK and PAM techniques to know details of advantages of PSK and PAM modulation techniques.

4.1 Initial work

Theoretical analysis of proposed work in detailed way by taking every important term into consideration including communication basics, OFDM, Different modulation schemes.

4.2 Practical work

The simulation coding structure is implemented in MATLAB by taking theoretical analysis as blueprint.

4.3 Recommendations for Further Investigation

Technology constantly changes its facet along with time. Consistent improvement has led for the creation of advance algorithms to solve the existing issues with ease. Communication industry has gained immense popularity in 21st century and proved its presence in every domain ranging from small distance to large distance. Mobile communications has majority share in communication industry and has become mandatory device for every purpose. Technological association with mobile systems has pave way for creation of advance algorithms for better performance which constantly changes. In near future FBMC is implemented to yield better performance but the process of development changes its facet along with time and its never ending process along with technology.

5. CONCLUSION

Using barcode we are going for efficient as well as secure data transmission based on DWT in DPSK OFDM is proposed successfully using MATLAB simulation. With the help of DWT, we reduced BER effectively. As BER is reduced, the transmission is effective and error free to embed more data its very easy. 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. Barcode modulation is very efficient technique which will be used further at any places where there is need of hardcopy to know some more information. Now in proposed technique we can embedd more data in very less area. We generated QR(Quick Response) code and scanned it to know the data stored in it. We analyzed BER performance between transmitted data and received data. Finally we showed that our proposed system will give better BER performance.

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