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Efficient Barcode Modulation Mechanism for Data Transmission in Mobile Devices

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ABSTRACT

The concept of 2-D barcodes is of great relevance for use in wireless data transmission between handheld el ectronic devices. In a typical setup, any file on a cell p hone, for example, can be transferred to a second cell phone through a series of images on the LCD which a re then captured and decoded through the camera of t he second cell phone. In this study, a new approach fo r data modulation in 2-D barcodes is introduced, and i ts performance is evaluated in comparison to other sta ndard methods of barcode modulation. In this new app roach, orthogonal frequency-division multiplexing (O FDM) modulation is used together with differential ph ase shift keying (DPSK) over adjacent frequency doma in elements. A specific aim of this study is to establish a system that is proven tolerant to camera movements, picture blur, and light leakage within neighboring pixe ls of an LCD

1. Introduction

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

The stability of communication systems depends on mo dulation technique, if a system is deployed with equippe d modulation mechanism it helps to achieve high efficie ncy and as well as better performance. Traditional modu lation systems have limitations in its architectural desig n which restrict them to operate in proper way and the a bnormal restriction results in complexity which eventual ly decline the total system performance. The research o n modulation system reveals an interesting fact that the modulation scheme alone cannot perform entire task wit h accuracy and it needs additional barcode system to per form the modulation scheme with security. Barcode syst em based modulation framework achieves high perform ance along with nearly low complexity

BARCODES have played a great role in facilitating nu merous identification processes since their invention in 1952. In fact barcode is a simple and cost-effective met hod of storing machine readable digital data on paper or product packages. As pressing needs to transfer even m ore data faster and with high reliability have emerged, t here have been many improvements that were made on t he original barcode design. Invention of two dimensiona l (2D) or matrix barcodes opened a new front for these c ost-effective codes and their application in more comple x data transfer scenarios like storing contact information , URLs among other things, in which QR codes have be come increasingly popular. A comparison of 2D barcod e performance in camera phone applications. Much of t he efforts in matrix barcode development have been ded icated to barcodes displayed on a piece of paper as that i s the way they are normally used.

2.OBJECTIVE

In this paper Differential Phase Shift Keying was combi ned with Orthogonal Frequency Division Multiplexing i

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n order to modulate data stream into visual two dimensional barcodes. It was shown that QPSK-OFDM modulation has serious shortcomings in the mitigation of camera LCD movements where the phase of each element changes continuously. On the other hand, addition of a differential phase modulator before OFDM to modulate the data stream into phase differences of adjacent elements (DPSK-OFDM) causes the motion effect to increasingly weaken because of its gradual change from element to element, contributing to a small deviation from the ideal phase in the received signal.

3.existing system

The transfer of data (a digital bit stream or a digitized analog signal) over a point-to-point or point-to-multipoint communication channel. Examples of such channels are copper wires, optical fibers, wireless communication channels, storage media and computer buses. The data are represented as an electromagnetic signal, such as an electrical voltage, radio wave, microwave, or infrared signal.

Analog or analogue transmission is a transmission method of conveying voice, data, image, signal or video information using a continuous signal which varies in amplitude, phase, or some other property in proportion to that of a variableThe messages are either represented by a sequence of pulses by means of a line code (baseband transmission), or by a limited set of continuously varying wave forms (pass band transmission), using a digital modulation method.

The pass band modulation and corresponding demodulation (also known as detection) is carried out by modem equipment. According to the most common definition of digital signal, both baseband and pass band signals representing bit-streams are considered as digital transmission, while an alternative definition only considers the baseband signal as digital, and pass band transmission of digital data as a form of digital-to-analog conversion

4.PROPOSED SYSTEM

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 and depth of color bit bits per channel. The maximum information is represented as =

4.1Inter Symbol Interference:

As communication systems evolve, the need for high symbol rates becomes more apparent. However, current multiple access with high symbol rates encounter several multi path problems, which leads to ISI. An **echo** is a copy of the original signal delayed in time. ISI takes place when echoes on different-length propagation paths result in overlapping received symbols. Problems can occur when one OFDM symbol overlaps with the next one. There is no correlation between two consecutive OFDM symbols and therefore interference from one symbol with the other will result in a disturbed signal

In addition, the symbol rate of communications systems is practically limited by the channel's bandwidth. For the higher symbol rates, the effects of ISI must be dealt with seriously. Several channel equalization techniques can be used to suppress the ISIs caused by the channel. However, to do this, the CIR – channel impulse response, must be estimated.

In addition, once the incoming signal is split into the respective transmission sub-carriers, a guard interval is added between each symbol. Each symbol consists of useful symbol duration, T_s and a guard interval, □*t*, in which, part of the time, a signal of T_s is cyclically repeated. This is shown in Fig.3.5.

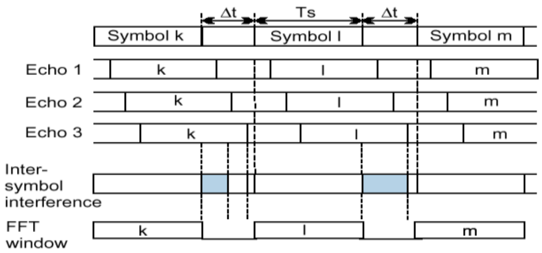

Fig. 1 Combating ISI using a guard interval

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As long as the multi path propagation delays do not exceed the duration of the interval, no inter-symbol interference occurs and no channel equalization is required.

4.2 Interference, Distortion, and Noise

When a camera is used to take a picture of a 2D barcode, certain image artifacts could impact the result of data extraction method. These artifacts are mainly due to the following

- Distance and angle between camera and LCD (perspective distortion);
- Camera and subject relative motion;
- Out of focus lens;
- Compression distortions;
- Unwanted ambient light sources;
- Dirt and permanent marks on the LCD;
- Noise (primarily additive Gaussian noise).

Moreover, nonlinear distortions exist in a typical optical wireless data transmission setup due to transmitter and receiver physical limitations that are discussed in . These undesirable effects should be addressed to ensure the feasibility of the algorithm under realistic scenarios, while preserving the ability for attaining high data transfer rates.

5 OVERVIEW DIAGRAM

The following figure shows again the block diagram of communication system. Such a system consists of ‘Sender’, ‘Channel’ and ‘Receiver’. In this lecture we focus on the channel aspect of the communication system. In the block diagram, s(t) is the transmission signal and ˆs(t) is the received transmission signal.

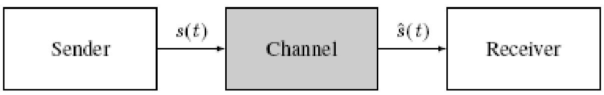
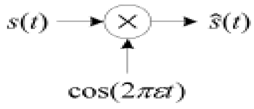


Fig. 2 Block diagram of communication system

5.1 Frequency offset channel

The frequency offset channel introduces a static frequency offset. One possible cause for such a frequency offset is a slow drifting time base, normally a crystal oscillator, in either transmitter or receiver. The frequency offset channel tests the frequency correction circuit in the receiver. The following figure shows the block diagram of the Frequency shift channel.

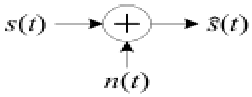


The mathematical model follows as:

$$\hat{s}(t) = s(t)\cos(2\pi\varepsilon t).$$

AWGN channel

For the Additional White Gaussian Noise (AWGN) channel the received signal is equal to the transmitted signal with some portion of white Gaussian white noise added. This channel is particularly important for discrete models operating on a restricted number space, because this allows one to optimise the circuits in terms of their noise performance. The block diagram of the AWGN channel is given in the next figure.



$$s(t) = s(t) + n(t)$$

Where n(t) is a sample function of a Gaussian random process. This represents white Gaussian noise.

5.2 Generation of QPSK:

Here the i/p binary seq. is first converted into a bipolar NRZ type of signal. This signal is denoted by b (t). It represents binary ‘1’ by ‘+1V’ and binary ‘0’ by ‘-1V’. The demultiplexer divides b (t) into 2 separate bit streams of the odd numbered and even numbered bits. Here Be (t) represents even numbered sequence and Bo (t) represents odd numbered sequence. The symbol duration of both of these odd numbered sequences is 2Tb. Hence, each symbol consists of 2 bits.

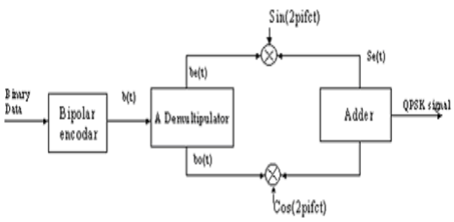


Fig.3 Generation of QPSK

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It may be observed that the first even bit occurs after the first odd bit. Hence, even numbered bit sequence Be (t) starts with the delay of one bit period due to first odd bi t. Thus, first symbol of Be (t) is delayed by one bit perio d due to first odd bit. Thus, first symbol of Be (t) is dela yed by on bit period 'Tb' with respect to first symbol of Bo (t). This delay of Tb is known as **offset**. This shows t hat the change in the levels of Be (t) and Bo (t) can't oc cur at the same time due to offset or staggering. The bit stream Be (t) modulates carrier cosine carrier and B0(t) modulates sinusoidal carrier. These modulators are the b alanced modulators. The 2 carriers are ÖPs.cos (2□Fc.t) and ÖPs.sin (2□Fc.t) have been shown in fig. Their car riers are known as **quadrature carriers.** Due to the offs et, the phase shift in QPSK signal is □/2.

5.3 CLIPPING

The clipping is the easiest technique to reduce the powe r by setting a maximum level for the transmitted signal. Though, this technique has several disadvantages:

- The performance of BER could be affected neg atively due to the in-band distortion caused by t he clipping.
- Also out-of-band radiation usually appears with clipping technique that could disturb the adjace nt channels

However, we can use filtering operation to decrease the appearance of the out-of-band radiation but the signal m ay exceed the maximum level of the clipping operation. The block diagram of clipping and filtering technique fo r PAPR reduction is exposed in Fig. In this figure, N de notes the number of subcarrier and L represents the over sampling factor. In the diagram, The IFFT generate $x'[m]$ which is the L-times oversampled signal. As shown i n fig, the FFT-IFFT filter is applied to allow the signal p assing through a band-pass filter (BPF) then through a l ow-pass filter (LPF). The outcome of the filtering stage is a less degraded BER performance and a reduced out-of-band radiation. Though, the PAPR reductions improv ements are gained at the cost of regret the peak where th e signal could go beyond the clipping level after applyin g the filtering operation

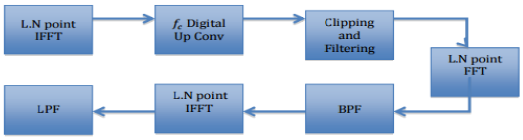

FIG 4: The scheme of clipping and filtering techniqu e for PAPR.

The signal $x\ p\ [m]$ is the pass band modulated one with carrier frequency. We symbolize the clipped form of the pass band-modulated signal as $xc\ p\ [m]$. The expressio n of this signal is shown in following equation

$$x_c^p[m] = \begin{cases} -A & x^p[m] \le -A \\ x^p[m] & |x^p[m]| < A \\ A & x^p[m] \ge A \end{cases}$$

Where the clipping level is denoted by A and (CR) is th e clipping ratio that can be represented as follow Where the RMS value of OFDM signal is denoted by σ and it i s well known that $\sigma = N$ for the baseband and $\sigma = N/2$ f or the passband OFDM signal

5.4 DPSK Modulator

DPSK takes the converted data as a input source. Each s ymbol is converted to a complex phase by following rul es

, , , ,

First bit modulates the Real component & second bit m odulates the imaginary component of the phase of each symbol. S matrix converted into Differential matrix D u sing following method:

- D(0,0)=S(0,0); (2)
- D(0,n)=D(0, n-1) × s (0,n)1≤n<N-2 (3)
- D(m, n)=D(m-1,n)×s(m,n)1≤m<M/2-1, 0≤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≤m<M/2-1, 0≤n<N/2-1, these two matrices are used to fill regions 1 and 2 of the transmission matrix.

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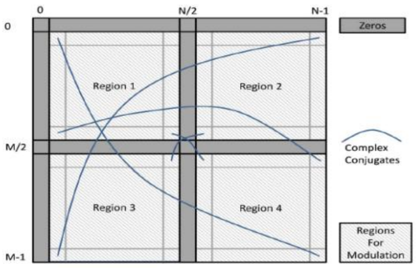


FIG 5 : Hermitian symmetric matrix used for DPSK -OFDM modulation.

The IFFT of this matrix would have real-valued output on display. Bended lines show location of complex conj ugate pairs.

5.5 AWGN channel

AWGN channel is widely used in OFDM. In OFDM mu ltipath signals are transmitted then these signals are rece ived as a train of pulses at the receiver .In this white Ga ussian Noise are considered with constant spectral densi ty.

5.6 DPSK Demodulator

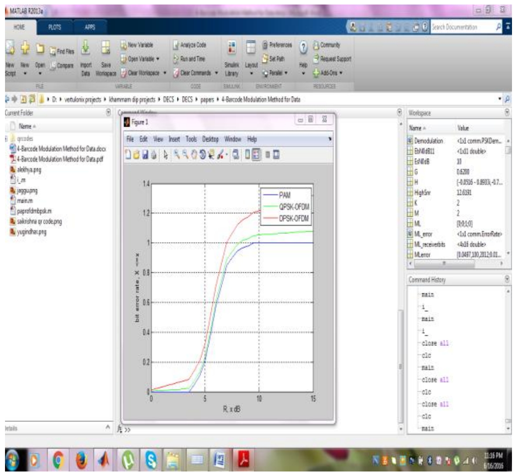
Data can be extracted using phase differences between r espective elements. Data corresponding to region 1 & 2 should be concatenated to form matrix R corresponding to transmitted matrix T.

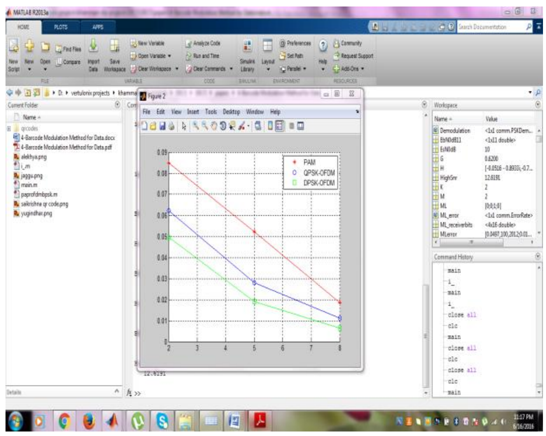
- Rd(0,0) =R(0,0)
- Rd(0,n) =R(0,n)×R*(0,n-1)0<n<N-2
- Rd(m,n)=R(m,n)×R*(m-1,n)0<n<N-2, 0<m <M /2-1

Finally, the received signal is to be detected as the phas e differences have been extracted. Each input bit may be calculated using constellation map of the transmitter. E ach element is evaluated using its real and imaginary co mponents. The sign of the real component determines th e first bit and sign of the imaginary components determi nes the second bit.

In wireless medium to increase the data rate with high p erformance orthogonal frequency division multiplexing (OFDM) is used which uses inverse fast Fourier transfor m at the transmitter to modulate a high bit rate signal on to 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 outpu t with lower computational complexity

6. RESULTS





7. CONCLUSION

In this paper Differential Phase Shift Keying was combi ned with Orthogonal Frequency Division Multiplexing i n order to modulate data stream into visual two dimensi onal barcodes. It was shown that QPSK-OFDM modulat ion has serious short comings in the mitigation of camer a LCD movements where the phase of each element cha nges continuously. On the other hand, addition of a diff erential phase modulator before OFDM to modulate the data stream into phase differences of adjacent elements (DPSK-OFDM) causes the motion effect to increasingly weaken because of its gradual change from element to element, contributing to a small deviation from the ideal phase in the received signal.

It was observed that under relative LCD-camera motions that generate error rates in excess of 30% in PAM and QPSK-OFDM, the proposed system of DPSK-OFDM will maintain an error rate less than 8% which is practically correctable using error correction coding. Future inquiries in a resolution to this problem have to address the best choice of differential pattern to optimize performance for various motion scenarios. Moreover, extension of the current two-bit per symbol constellations increases data transfer capacity, and its BER performance evaluation would be required. Nevertheless, a study on the effect of perspective correction errors on the BER performance of this algorithm compared to the other ones could augment our understanding of its applicability to real world scenarios

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