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COMPARISION IN MODULATION CARRYING OUT ON PERSPECTIVE OF FSO COMMUNICATION PERFORMING

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Abstract - *Free space Optical (FS0) communication has been appear as a more conventional means of communication instead than the conventional optical communication. Performance of FSO communication system calculate upon number of constant quantity. These parameters can be divided into two categories such as (i) internal parameters (ii) external parameters. Internal parameters are obsessed with design of FSO system and include wavelength, optical power, transmission bandwidth, divergence angle and optical loss on the transmitter and bit error rate (BER), receiver lens diameter, and obtain field of view (FOV) on the receiver. Outer parameters are connected with environment such as Visibility, atmospheric attenuation, scintillation etc. which come below the effects of atmospheric conditions. There are a abstraction of techniques to take the edge off these channel effects such as choice of an streamlined modulation scheme, aperture averaging, receiver diversity, diversity (in space, time or frequency), coding, adaptive optics etc. The keen focus of our paper will be on effective modulation for F SO system. We will discuss various modulation schemes associated with FSO systems.*

Key Words: Bit error rate, free space optics, ON OFF Keying, Quadrature amplitude modulation.

1. INTRODUCTION

FSO scientific discipline function same as fiber optics but at a very low cost and very fast deployment speed [1]. FSO is been emerging as a viable wireless communication system for long and short haul networks. FSO communication entirely runs by means of light thus modulation show a vital r ole for transmitting data here. As there are lot of modulation techniques forthcoming for wireless communication thus it is very important to choose a modulation technique which makes the system more efficient according to the desirable conditions . This paper talk about a comprehensive study of FSO communication with main focus to study different modulation techniques so as to minimize the contrastive losses fetching place when light signal passes through free space's systems are mainly implemented by employing On–Off keying (OOK) modulation because of the simple system and low cost, however alternative modulation technique, pulse-position modulation (PPM), has been proposed for FSO communication instead of (OOK) modulation [2]. It has been found that PPM is more power efficient as compared to OOK but has poor bandwidth efficiency. To overcome the limitations of OOK and PPM, sub carrier phase-shift keying (PSK), Quadrature amplitude modulation (QAM) has been planned for high bandwidth efficiency [3]. Also in order to come through a major spectral efficiency than that of PSK, the use of sub carrier quadrature -amplitude modulation (QAM) for FSO systems has been recently proposed. The error rate of FSO systems using sub carrier QAM over log-normal and gamma–gamma turbulence channels was derived in [4]. Also in [5] Hassan et al. traced the closed-form aspect of error rate for gamma– gamma and log-normal channels exploitation a series expansion. Quadrature amplitude Modulation (QAM) is a complicated name for a simple technique. It is basically the combination of amplitude modulation and phase shift keying. We can say quadrature amplitude modulation is a modulation in which data is transferred by modulating the amplitude of two separate carrier waves, mostly sinusoidal, which are out of phase by 90 degrees (sine and cosine) therefore due to this phase difference, they are called quadrature carriers. In simple (OOK) modulation signals exhibit only two positions enabling a transfer of either a 0 or 1 but in quadrature amplitude modulation, it is achievable to transfer more bits per orientation as there are multiple points of transfer.

2. Modulation of a wave

Modulation means to change .So changing the carrier wave in accordance to the signal is termed as modulation. Frequency of an RF channel is related to the frequency of a carrier wave. A carrier wave is sine wave with a constant frequency but it doesn't carry much information. To add related data information, input signal is mounted, on top of the carrier wave. This operation of loading an input signal onto a carrier wave for required data transmission is called modulation. In other words, modulation changes the shape of a carrier wave to somehow encode the speech or data information that we were interested in carrying. Modulation is like hiding a code inside the carrier wave. There are different ways for modulating the carrier wave. One of the common ways is to tweak the height of the carrier or we can say the amplitude of the carrier. If a modulating signal's amplitude varies with the loudness of a user's voice and then adds this to the carrier, then the carrier's amplitude will change corresponding to the input signal that's been loaded on to it. In various modulation techniques, the message signal frequency is raised to a range so that it is more useful for transmission. The value of modulation in communication

system is that the signals from several origin are transmitted through a common channel simultaneously by using multiplexers. If these signals are transmitted simultaneously with certain bandwidth, they cause interference. To overcome this, speech signals are modulated to respective carrier frequencies in order for the receiver to tune them to desired bandwidth of his own selection within the range of transmission.

2.1 Need of modulation:

Also the necessity for modulation originate from the antenna size .The antenna size is inversely proportional to the frequency of the radiated signal. The magnitude of the antenna aperture size is at least one by tenth of the wavelength of the signal. So if the signal has a frequency of 5 KHz its antenna size is not practicable therefore, elevation frequency by modulating process will for certain decrease the height of the antenna. Modulation allows transferring the signals over large distances, since it is not accomplishable to send low-frequency signals for longer distances. Similarly, modulation is also important to allocate more channels for users and to increase noise immunity.

2.2 Type of modulation:

The two types of modulation are analog and digital modulation techniques. In both the techniques, the base band information is converted to Radio Frequency signals, but in analog modulation these RF communication signals are never-ending range of values, whereas in digital modulation these are planned discrete states.

Digital Modulation: In digital modulation technique the carrier wave is modulated with the help of digital bits (0 or 1). The great benefit of FSO links is the unguided channel itself. But the FSO system is prone to atmospheric uncertainties like rain, snow, fog, variation of temperatures ,wind speed etc., thus reliable performance remains a major situation [6]. On off keying is one of the simplest modulation technique used for transmission of data in FSO, but the performance of the system under On off keying systems typically gathering with the indefinite quantity of turbulence resulting to errors in the data [7].. To tackle these kinds of problems caused by turbulence an appropriate modulation technique is enforced. Several modulation techniques to improve performance efficiency of FSO system have been recently proposed [8].Basic digital modulation techniques include ASK (Amplitude shift keying), FSK (Frequency shift keying) and PSK (Phase shift keying).

3. Comparison between different modulation schemes:

Different digital modulation techniques have different symbol rate which is characterized as number of samples per second similarly they have various bit rates which is defined as number of data bits per second. The table I shows comparison between these rates for various modulation techniques.

Table -1:

Modulation Technique	Symbol Rate	Bit Rate
i)ASK , FSK , PSK	N	N
ii)QPSK	N	N
iii)4-PSK	N	2N
iv)8-PSK	N	3N
v)16-QAM	N	4N
vi)32-QAM	N	5N
vii)64-QAM N 6N	N	6N
viii)128-QAM	N	7N
ix)256-QAM	N	8N

Table 1 Bit rate and baud rate comparison of different modulation types the bandwidth required for the transmission of the signal is stated by symbol rate.

Where;

N = number of bits used.

M =number of bits used per sample.

Also data compression assist higher data transmission rates at required bandwidth. The Table 2 shows the number of modulated bits, the required minimal bandwidth and many possible output conditions for Amplitude shift keying (ASK), Frequency shift keying (FSK), Phase shift keying(PSK) and Quadrature amplitude modulation (QAM) for bit rate f b. The best accomplishable manner to identify the presentation of FSO communication instrumentation is bandwidth ratio.

Table -2:

Modulation Scheme	*Modulated Bits*	*Modulated states*	*Minimum Bandwidth*
i)FSK	*1 bits*	*2*	*fb*
ii)ASK	*1 bits*	*2*	*fb*
iii)BPSK	*1 bits*	*2*	*fb*
iv)QPSK	*2 bits*	*4*	*fb/2*
v)QAM	*2 bits*	*4*	*fb/2*
vi)8-PSK	*3 bits*	*8*	*fb/3*
vii)8-QAM	*3 bits*	*8*	*fb/3*
viii)16-PSK	*4 bits*	*16*	*fb/4*

ix)16-QAM	*4 bits*	*16*	*fb/4*
x)32-PSK	*5 bits*	*32*	*fb/5*
xi)32-QAM	*5 bits*	*32*	*fb/5*
xii)64-PSK	*6 bits*	*64*	*Fb /6*
xiii)64-QAM	*6 bits*	*64*	*Fb /6*
xiv)128-PSK	*7 bits*	*128*	*Fb /7*
xv)128-QAM	*7 bits*	*128*	*Fb /7*

Table 2 Comparison of different modulation types

Bandwidth efficiency demonstrate that quicker in velocity bits are transmitted under a particular bandwidth. Bandwidth efficiency is defined by the formula given below:

$$\text{Bandwidth efficiency} = \frac{bit\ rate\ f_b}{Required\ bandwidth}$$

4. Conclusion

The paper statement that as we go high in the order of modulation, data can be transmitted at higher rates but the expectation of error also increases. With increase in data rate, signal to noise ratio improves just then it also initiate more than flawed bits which results in irreparable damage to transmitted data. In short, we have to compromise for one either data transmission rate or abstraction of noise that our receiver can handle. Based on the belief of bandwidth and bit rate from table 1 and 2 we can express that higher levels of QAM have high bandwidth ratio.

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