Appraising the Modulation Techniques for Wireless Sensors

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***Abstract*--**Optical wireless sensors are moderately find its place in the advanced wireless optical communication. These wireless sensors are short range sensors basically for indoor applications operated on infrared frequency. Applications such as remote environmental monitoring and target tracking has been enabled by the availability, particularly in recent years of sensors that are smaller, cheaper, and intelligent. In this paper, we are designing a optical wireless system for indoor system and discus its modulation technique.. The system will operate on the data rate of 1Gbps and evaluate the result in the form of eye diagram Frequency measurements are conducted to characterize the link up to 1 GHz, and are transformed to obtain impulse responses and eye diagrams, further MIMO can be used for reducing the multipath delay.

Index Terms*—Channel characterization, infrared, optical wireless communication, LED lighting, sensor networks.*

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I. INTRODUCTION

Wireless sensor network (WSN) widely used due to its various advantages as of its low cost, commercial off the shelf component fabrication, low tolerance power capability, low traffic prone zone accessibility, wide variety of application. [1] Compared to RF communications, indoor OWC systems provide wide optical bandwidth due to the range of wide inherent frequencies which make OWC more dependable frequency system than any other system. OWC system uses line of sight (LOS) communication due the increasing requirement of higher speed, higher power efficiency, lower path loss and lower multi-path distortion in [2]. The transmitter of the OWC has lower divergence angle by which it is capable of providing lower path loss and also capable of providing multipath inducing distortion in the communication process or it can be say that neglible. Moreover, when OWC system is using a direct LOS link its normally employing a photo detector (PD) with a smaller surface offers a large bandwidth and improved sensitivity [3].

II. OPTICAL INDOOR WIRELESS CHANNEL SETUP CHARACTERSTICS

At present, there are various alternatives for compromising the OWC that provide high bandwidth. As for the discussion there are multiple high-bandwidth laser transmitters available in the market or can be built with off-the-shelf components that can be connected to the high-gain and high-sensitivity photo-detectors, such as the photo-multiplier tube (PMT) and the avalanche photo-diode (APD). Take a sample, frequency characterization up to 1GHz can be achieved by using narrow FOV (field of view) receivers with using laser diodes and PMTs in previous time [4]. For this project a laser diode is used as a transmitter and an avalanche photodiode (APD) is used as a receiver, and then obtain the frequency domain response and time domain response. In [5], the authors reduce SNR fluctuations by creating the arrangements with LED. It was shown that by lowering the signal propagation delay its multipath distortion can be reduced and also by optimizing the divergence angle of LED. However, a more ethical optical power distribution was proposed in [12] a holographic diffuser and get lower ISI. In [6] a system employing spotlights for higher data rate transmission was reported, demonstrating that indoor NLOS-OWC links using LEDs having large divergence angle offer more channel distortion that that of the LED using small divergence angle.

Therefore, for achieving a higher transmission bandwidth and a more uniform optical power distribution, multi cell NLOS-OWC systems are the preferred solution. However, in previous research quiet attention has been given to LEDs and its impact on the time dispersion and the channel transmission bandwidth. And the considerable point of discussion is that the divergence angle is an essential parameter of an LED and it significantly affects the received power distribution and the channel distortion in indoor NLOS-OWC systems.

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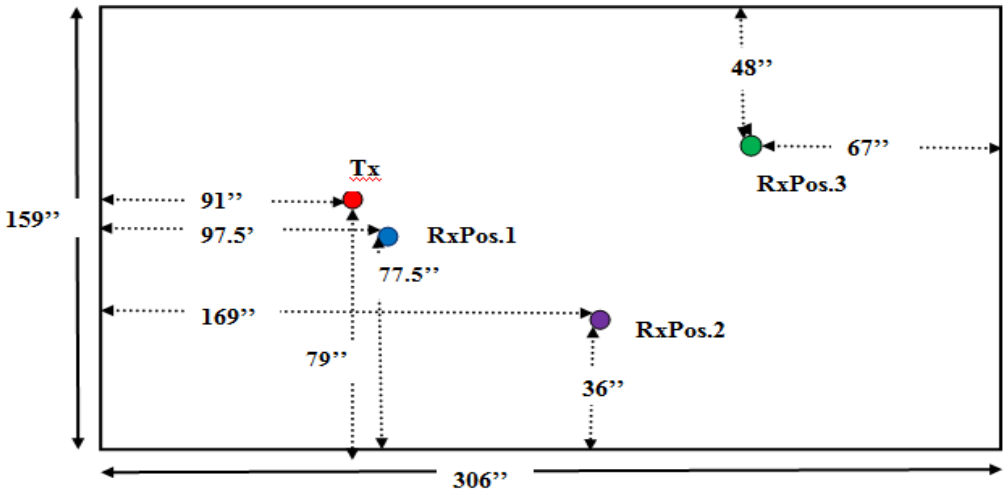

Fig-1 Representing a Transmitter and Receivers Locations Inside an Indoor Field

1- MEASURING POWER REQUIREMENT AND DELAY CONFIGURATION

There are three classes of modulation schemes by which the relationship between the normalized delay spread and the multipath power requirement can be studied:

- On–Off keying (OOK),
- Pulse-position modulation (PPM),
- Multiple-subcarrier modulation (MSM).

While using any one of these configuration, the LOS configurations (transmitter placed at the ceiling and pointed down) and diffuse configurations (transmitter placed at desk height and pointed up) many channels were shadowed (by an object placed next to the receiver), the receiver was placed at the desk height and pointed upward during the time of all measurements.

2-WIRELESS STANDARDS AND SYSTEMS

Their are basically two dominant wireless infrared technologies using in the recent time,

- IrDA and
- IEEE 802.11

A. INFRARED DATA ASSOCIATION STANDARDS (IRDA)

The Infrared Data Association, is an association has standardized low-cost optical data links and appears on variable portable devices including notebook, computers, personal digital assistants, and also various computer peripherals such as printers. Ir PHY is a present physical layer standard version. Data rates from 2.4 kb/s to 4 Mb/s are supported [7] in an IRDA and the link speed of communication is negotiated by starting at 9.6 kb/s. Mostly in a transmission standards there are short range sensors, with the directed links of 0m to 1m of range. For the transmitter configuration the half angle must be between 15 and 30 degrees, and the receiver Field-of-view must be at least 15 degrees. The transmitter also must have a peak-power wavelength between 850 nm and 900 nm.

B. IEEE 802.11 AND WIRELESS LANS

The IEEE has also a publication set of standards for wireless LANs i.e IEEE 802.11. The IEEE802.11 standard is designed for to fit into the structure of the suite of 802 LAN standards. Hence, it encapsulates both the physical layer (PHY) and medium access control layer (MAC) leaving the logical-link control (LLC) to 802.2. The MAC layer uses a form of carrier-sense multiple access with collision avoidance (CSMA/CA).

The original standard of the wireless LAN supports both radio and optical physical layers with a maximum data rate of 2Mb/s or still counting. The 802.11b standard also adds a 2.4 GHz radio physical layer at up to 11 Mb/s and 802.11a standard adds a 5.4 GHz radio physical layer at up to 54Mb/s.

3- EYE DIAGRAMS

Eye diagrams is a graphical interface of showing noise margins on the CRO(cathode ray oscilloscope) by using impulse response, simulations for 1Gbps and 800 Mbps can be run in indoor optical wireless links with the receiver located at different positions. The modulation technique can be chosen between On-Off Keying (OOK) modulation and QPSK modulation and found that OOK is suited for indoor wireless communication, since OOK is the most widely used transmission scheme for such links, and it offers least complexity of implementation without unreasonable degradation in performance. Rectangular pulses are transmitted on the transmitter laser with maximum power output occurring during symbol '1' and no power is output during symbol '0'. The average transmit power of the modulated data stream can also be varied to compete is also

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changed to use the complete the laser in linear range and can be modulated [8]. Thus, the average optical power output of the laser used in indoor applications can be increased to 24.7 dBm.

4- APPLICATIONS OF INDOOR WIRELESS COMMUNICATION

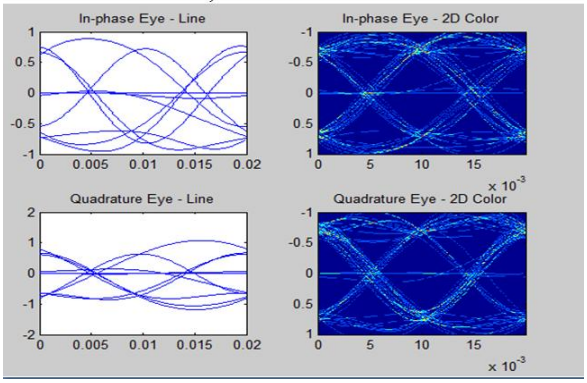
The various primary and peculiar commercial applications of indoor wireless communication are as follows:

- It uses Short-term cable-less connectivity for communication (business cards, schedules etc) between various users. The primary example is IrDA systems (see Section 2).
- Wireless local area networks (WLANs) can provide network connectivity inside buildings, medical colleges, industry etc. This can either be an extension of existing LANs to facilitate mobility, or to establish an add hoc networks where there is no LAN. The primary example is the IEEE 802.11 standard (see Section 2).
- Building-to-Building connections for high-speed network access or metropolitan or campus-area networks.
- Wirelessly control devices such as wireless mice, remote controls, wireless game controllers, and remote electronic keys.

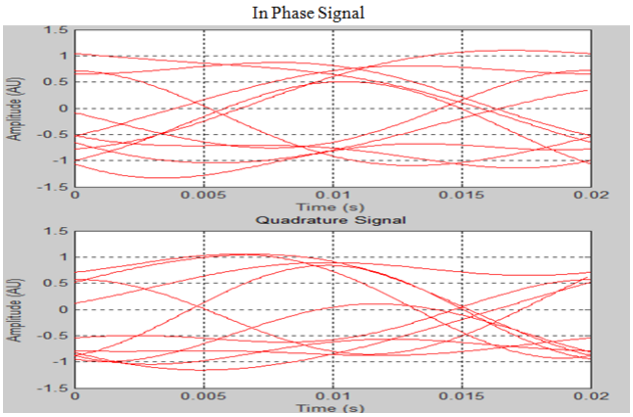
III. RESULTS

For measuring the frequency and time domain characteristic of an indoor wireless communication channel operating nearly at infrared frequency multiple spot diffusing technique is optimum. With an Intensity Modulated Directly Detected (IM/DD) modulation performance of the optical channel can be improve. A comparison is shown in terms of eye diagrams using QPSK modulation by different frame length and SNR.

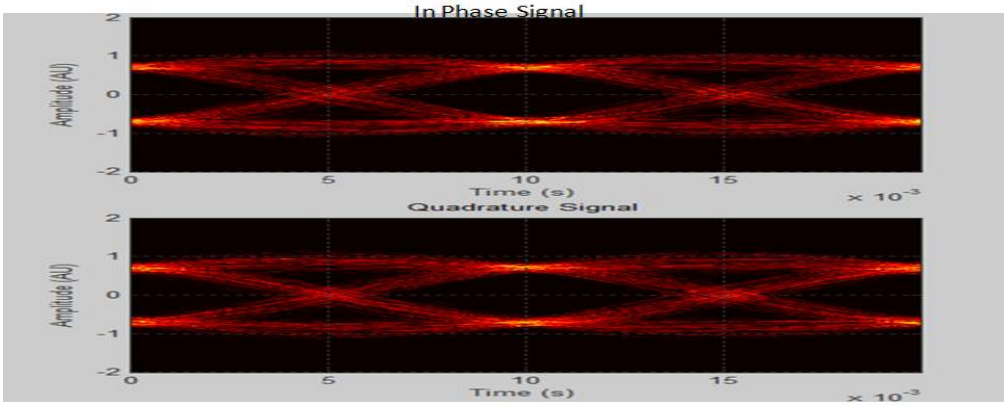
EYE DIAGRAM OF TRANSMITTED SIGNAL FOR SNR=10 , FRAME LENGTH=100



EYE DIAGRAM FOR NOISY SIGNAL



EYE DIAGRAM AFTER FILTERING FOR SNR=20, FRAME LENGTH=1000



IV. CONCLUSION

The use of indoor wireless communication channel nearly at infrared frequency can provide a useful complement to radio based systems, particularly for systems requiring low cost, light weight, moderate data rate, and only requiring short ranges Infrared systems have already proven their importance for short-range temporary communications using LOS Configuration or Diffused LOS Configuration and in high data rate longer range point-to-point systems. These sensors are easy to deployed flexible to use and also be created by commercial off the shelf component.

REFERENCES

[1] I. F. Akyildiz, W. Su, Y. Sankarasubramaniam, E. Cayirci (2002). A survey on sensor networks, *IEEE Communication Magazine*, vol. 40, no.8, pp.102-114

[2] H. Chen, H. van den Boom, E. Tangdiongga, and A. Koonen, "30Gbit/s Bi-directional Transparent Optical Transmission with an MMF Access and an Indoor Optical Wireless Link," *Photonics Technology Letters, IEEE*, vol. PP, pp. 1-1, 2012.

[3] F. E. Alsaadi and J. M. H. Elmirghani, "Beam power and angle adaptation in multibeam 2.5 Gbit/s spot diffusing mobile optical wireless system," *Selected Areas in Communications, IEEE Journal on*, vol. 28, pp. 913-927, 2010.

[4] R. J. Green, H. Joshi, M. D. Higgins, and M. S. Leeson, "Recent developments in indoor optical wireless systems," *IET Communications*, vol. 2, pp. 3-10, 2008.

[5] S. Jivkova and M. Kavehrad, "Indoor wireless infrared local access, multi-spot diffusing with computer generated holographic beam-splitters," in *Communications, 1999. ICC '99. 1999 IEEE International Conference on*, vol. 1, pp. 604-608, 1999.

[6] N. M Aldibbiat, Z. Ghassemlooy, and R McLaughlin, "Indoor optical wireless systems employing dual header pulse interval modulation (DH-PIM)," *International Journal of Communication Systems*, vol. 18, no. 13, pp. 285-305, 2003.

[7] H. Elgala, R. Mesleh, and H. Haas, "Indoor optical wireless communication: potential and state-of-the-art," *Communications Magazine, IEEE*, vol. 49, pp. 56-62, 2011.

[8] L. Xia, J. Vucic, V. Jungnickel, and J. Armstrong, "On the Capacity of Intensity-Modulated Direct-Detection Systems and the Information Rate of ACO-OFDM for Indoor Optical Wireless Applications," *Communications, IEEE Transactions on*, vol. 60, pp. 799-809, 2012.

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