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Performance Enrichment Of Directed Beam Indoor Optical Wireless Communications

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***Abstract*— This paper analyses the Directed beam indoor Optical links. The performance of Directed beam indoor Optical links improves by the receiver field of view. In Directed Line of Sight $\left(L_{L.O.S}\right)$ communication, the Concentrator or Channel Gain rises on reducing the value of receiver Field of View angle $\left(F_{F.O.V}\right)$. Therefore, the former variable is inversely proportional to the latter variable. The maximum and minimum average received powers increases on reducing the values of Field of View angle. In this paper, the line of sight channel gain is calculated at different values of Field of View angle $\left(F_{F.O.V}\right)$.**

***IndexTerms*—Field of View, Optical Wireless Communications, Directed line of sight communication, Multispot Diffuse configuration.**

I. Introduction

Optical Wireless Communications (OWC) is extremely protected. It has numerous utilizations in different area due to its unlicensed enormous optical bandwidth [1], [5-8]. Picking up signal from exterior premises of any room is almost impractical since optical signals optical signals are not able to pass through non-transparent things.

Thus, helps in enhancing the safety measures of wireless communication [1]. In addition to this, OWC technology is mainly reasonable for indoor areas that are easily detectable to electromagnetic interferences, e.g. Offices, Malls and Hospital etc [11]. OWC appeared out as a better and alternate solution of Radio Frequency. The two frameworks which are generally utilized in OWC are Diffuse and Directed line of sight $L_{L.O.S}$. In diffuse configuration, the exposure of infrared system is constrained to the concerned area's boundaries [11], [12]. Wireless optical communication has numerous benefits that make it suitable for using in offices, hospital, malls etc., such as the cheap transceivers; free from dangerous radiation interferences and unlimited license free bandwidth. The first demonstration of a systems utilizing optical CDMA in optical fiber link and also in free space was given by NICT, Japan. [2][3]. Optical channel in general utilizes Intensity Modulation with Direct Detection (IM/DD). There are two main drawbacks:

1. The mean optical channel input is directly proportional to the average transmit optical power [2].
2. Only a positive input to the optical channel is required.

The two significant issues of Optical Wireless Communications are expansion of network bandwidth resources and advancement of communication streams. In general, light sources and photo-detectors are utilized for indoor communication in the optical wireless system. It is more cost-effective and simple to execute than Radio Frequency [4]. There is no interference from the other adjoining regions. Wireless optical communication is affected by turbulence in the climate, scattering and atmospheric absorption and thus leads to signal attenuation. It is restricted to be used only for normal power transmission due to the need of the eye protection [9], [10].

II. Link Configuration

1. Directed Line of Sight ($L_{L.O.S}$)

The directed link Figure 1 utilizes a $L_{L.O.S}$ for communication connecting a narrow $F_{F.O.U}$ of receiver $\left(R_X\right)$ and narrow beam transmitter $\left(T_X\right)$[1]. In existing $L_{L.O.S}$ communication angle between transmitter and receiver are carefully aligned and achieve high transmission speeds (up to 200 M bit/s) [3]. When used a receiver with a narrow $F_{F.O.V}$ in $L_{L.O.S}$ communication the ambient light sources (like florescent and incandescent) is mostly discarded [5], [7].

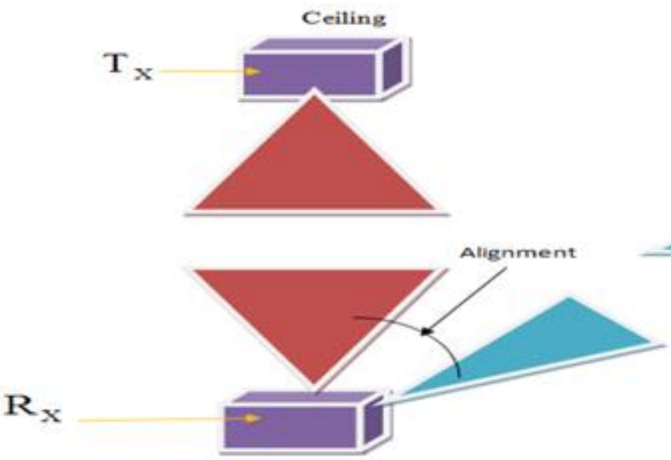

Figure 1: Directed Line of Sight ($L_{L.O.S}$)

$L_{L.O.S}$ Links design increases efficiency of power and reduces distortion that occurs due to multipath. The presence of an undisturbed $L_{L.O.S}$ path between the transmitter and receiver affects the performance of the link. The blocking liability and the lack of freedom of movement are the main drawbacks. LEDs are used as the main optical source instead of LDs but its capacity is limited to few Mbps [6], [7]. The main applications of $L_{L.O.S}$ links are those which have the fixed terminals as in computers that are used in offices and hospitals etc.

2. Multispot Diffuse (quasi-diffuse) Configuration

Multispot Diffuse configuration utilizes a receiver that basically receives radiation from a partial range of angles and enlightens the walls and the roofs with controlled radiation [4]. The power efficiency of diffuse links can be enhanced utilizing Multispot Diffuse configuration. Figure 2 displays the geometry of such systems. A group of several beams is utilized with a collection of narrow $F_{F.O.V}$ receivers that are meeting at one point. All the trail lengths from transmitter to receiver are nearly at same distance and this becomes the cause for non-scattering of the spot [6].

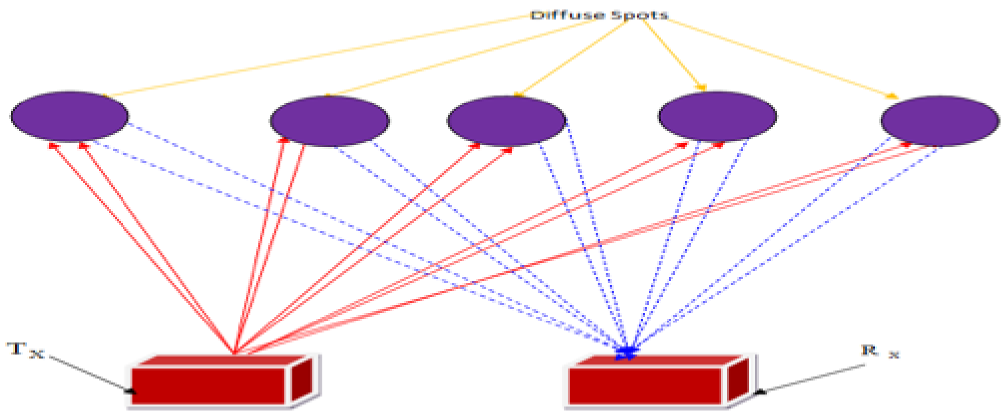

Figure 2: Communication Link of a multispot diffusing using a multi-beam transmitter

III. Simulation Outcomes for LOS at various Fields of View angle

Table 1 Maximum and minimum received power for various Field of View $(F_{F.O.V})$

S. No	Field of View $(F_{F.O.V})$	Maximum Received Power(dBm)	Minimum Received Power(dBm)
1	88	-35.93	- 46.29
2	84	-35.91	- 46.27
3	80	-35.86	- 46.23
4	76	-35.80	- 46.17
5	72	-35.71	- 46.08
6	68	-35.60	- 45.97
7	64	-35.47	- 45.83
8	60	-35.66	- 46.03
9	56	-35.11	- 45.48
10	52	-34.89	- 45.26
11	48	-34.64	- 45.01
12	44	-34.35	- 44.71

13	40	-34.01	- 44.38
14	36	-33.62	- 43.99
15	32	-33.17	- 43.54
16	28	-32.65	- 43.01
17	24	-32.02	- 42.39
18	20	-31.27	- 41.64

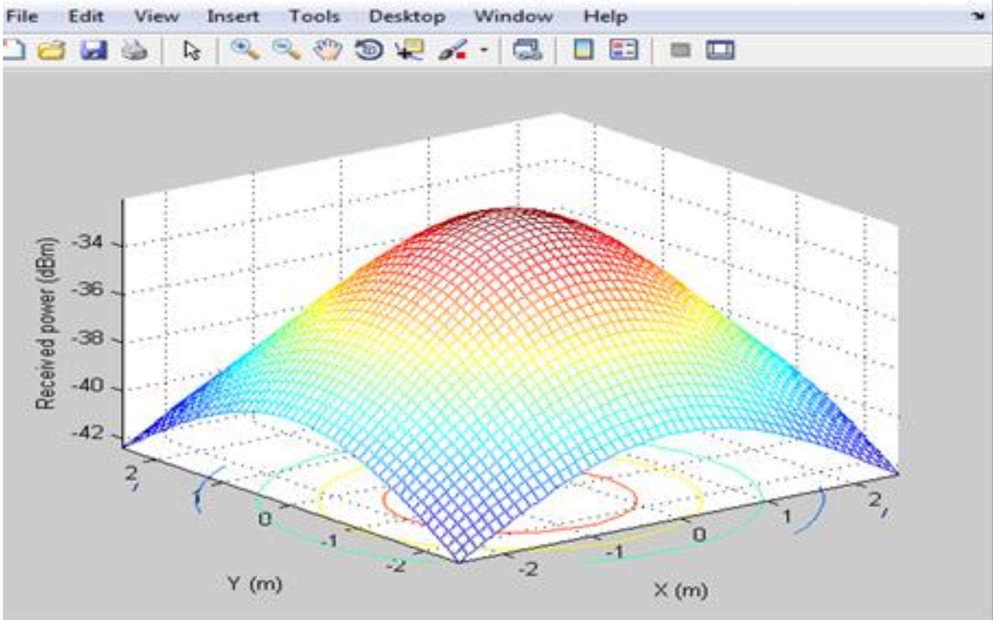

Figure 3: Line of sight ($L_{L.O.S}$) concentrator gain

IV. Conclusion

Following conclusion can be withdrawn on point basis after analyzing the simulation results in this article.

1. The Field of View $(F_{F.O.V})$ is directly proportional to the photo detector area and the lens collection area. This signifies that photo detector area and the lens collection area are responsible for the value of the Field of View $(F_{F.O.V})$ of the optical detector.
2. In Directed Line of Sight $(L_{L.O.S})$ communication, the Channel or Concentrator Gain rises on mitigating the value of receiver Field of View angle $(F_{F.O.V})$. Therefore, the former variable is inversely proportional to the latter variable.

The maximum and minimum average received powers rises on reducing the values of Field of View angle.

References

[1] J. B. Carruthers, "Wireless Infrared Communications," in Wiley Encyclopedia of Telecommunications, John Wiley & Sons, Inc., 2003.

[2] Z. Ghassemlooy, "Indoor Optical Wireless Communications Systems – Part I: Review." Newcastle upon Tyne, UK: School of Engineering, Northumbria University, 2003.

[3] H. Elgala, R. Mesleh, and H. Haas, "Indoor optical wireless Magazine, IEEE DOI - 0.1109/MCOM. 2011.6011734, vol. 49, no. 9, pp. 56–62, 2011 communication: potential and state-of-the-art," Communications.

[4] Rui Hou1 Yawen Chen2 Jigang Wu1 Haibo Zhang2 A Brief Survey of Optical Wireless Communication Proceedings of the 13th Australasian Symposium on Parallel and Distributed Computing (AusPDC 2015), Sydney, Australia, 27 - 30 January 2015.

[5] Van Der Togt, R., van Lieshout, E. J., Hensbroek, R., Beinat, E., Binnekade, J. & Bakker, P. (2008), `Electromagnetic interference from radio frequency identification inducing potentially hazardous incidents in critical care medical equipment', Jama299(24), 2884{2890}.

[6] Hany Elgala, Bremen Raed Mesleh, Harald Haas, "Indoor Optical Wireless Communication: Potential and State- of-the-Art", IEEE Communications Magazine •September 2011

[7] J. R. Barry, J. M. Kahn, W. J. Krause, E. A. Lee and D. G. Messerschmitt, Simulation of multipath impulse response for indoor wireless optical channels, IEEE Journal on Selected Areas in Communications, 11, 367–379, 1993.

[8] O. Bouchet, M. El Tabach, M. Wolf, D. C. O'Brien, G. E. Faulkner, J. W. Walewski, S. Randel, M. Franke, S. Nerreter, K. D. Langer, J. Grubor and T. Kamalakis, Hybrid wireless optics (HWO): Building the next-generation home network, Communication Systems, Networks and Digital Signal Processing,2008. CNSDSP2008. 6th International Symposium on, Graz, Austria, pp. 283–287. 2008.

[9] W. Hirt, J. Petrilla and Y. Yuuki, "Proposed changes to IrDA Serial Infrared Physical Layer link Specification for 16 Mbps Addition (VFIR) Final Proposal," c.0.90, jan.8, 1999 (adopted with status final by the IrDA Board of Directors, San Fransisco, CA, JAN. 28, 1999).
[10] N. Hayasaka, T. Ito: Channel modeling of non directed wireless infrared indoor diffuse link, Electronics and Communications in Japan, vol. 90, pp. 9-19, 2007.
[11] J. R. Barry: Wireless Infrared Communications. Boston: Kluwer Academic Publishers, 1994.
[12] A. Moreira, R. Valadas, and A. Duarte, "Performance of Infrared Transmission Systems Under Ambient Light Interference," IEE Proc. Optoelecronics, vol. 143, no. 6, Dec. 1996, pp. 339–346.